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MONITORING OF DOWNSTREAM SALMON AND STEELHEAD AT FEDERAL HYDROELECTRIC FACILITIES

1994 ANNUAL REPORT

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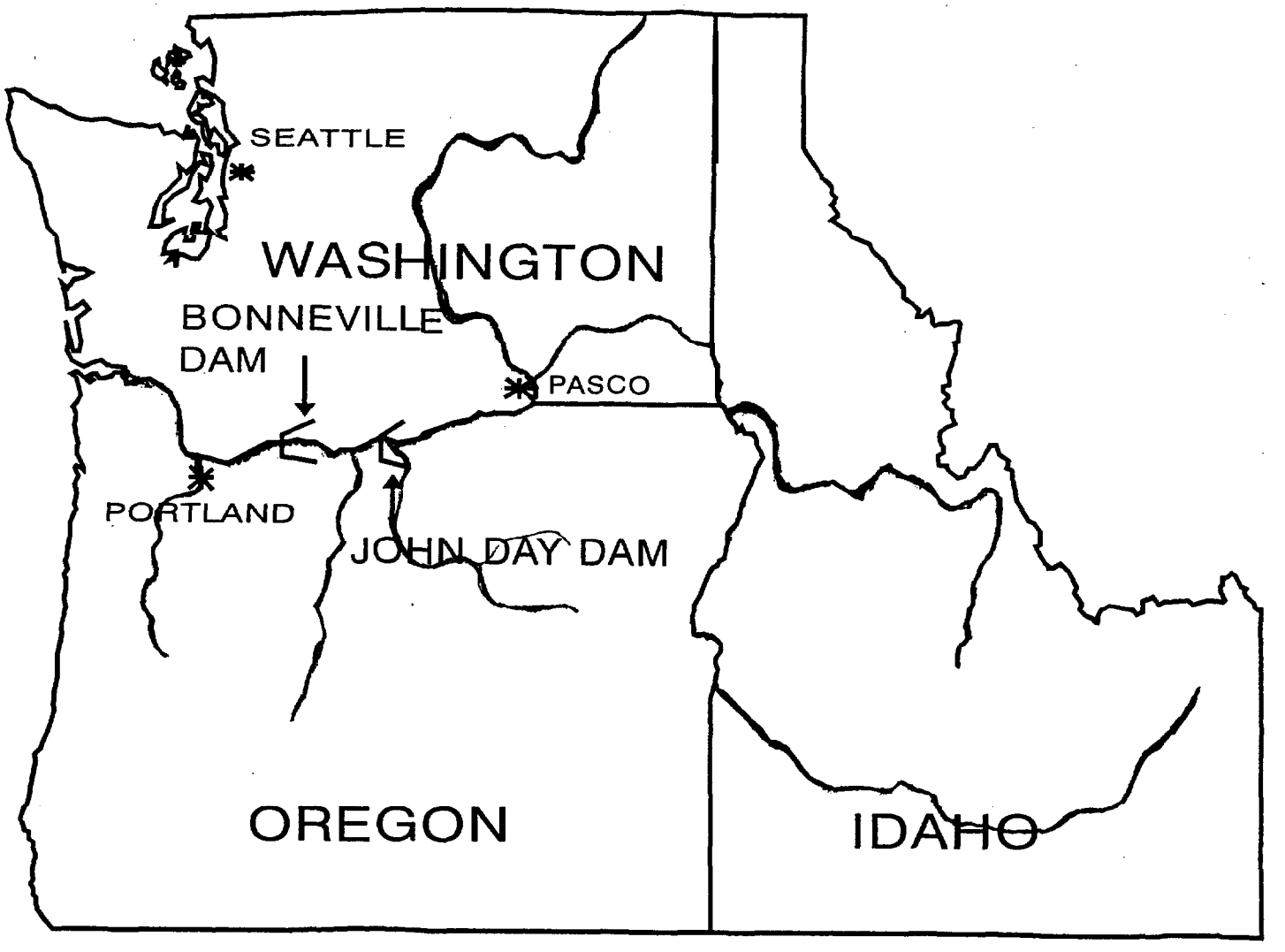


FIGURE 1. National Marine Fisheries Service Smolt Monitoring Sites at John Day and Bonneville Dams on the Columbia River.

INTRODUCTION

The seaward migration of juvenile salmonids was monitored by the National Marine Fisheries Service (NMFS) at Bonneville (BON) and John Day (JDA) Dams on the Columbia River in 1994 (river mile 145 and 216, respectively, Figure 1). The NMFS Smolt Monitoring Project is part of a larger Smolt Monitoring Program (SMP) coordinated by the Fish Passage Center (FPC) for the Columbia Basin Fish and Wildlife Authority. This program is carried out under the auspices of the Northwest Power Planning Council Fish and Wildlife Program and is funded by the Bonneville Power Administration..

The purpose of the SMP is to index Columbia Basin juvenile salmonid stocks and develop and implement flow and spill requests intended to facilitate fish passage. Data is also used for travel time, migration timing and relative run size magnitude analysis. The purpose of the NMFS portion of the program is to provide FPC with species specific data; numbers, condition, length, brand recaptures and flow data from John Day and Bonneville Dams on a daily basis.

METHODS AND MATERIALS

JOHN DAY DAM

One airlift pump system of the type described by Brege et al. (1990), was operated in gatewell 3B (Figure 2). Collected fish were examined hourly, or every other hour when numbers were low, over the 24 hour sample day (7AM to 7AM), seven days per week. Sampling began at 0700 hrs on 5 April and ended at 0700 hrs on 30 September. Fish were collected in a 450 gallon tank suspended at water level in the gatewell. Each hour this collection tank was raised and fish were gravity fed to holding tanks in a fish handling building via a 6" PVC pipe.

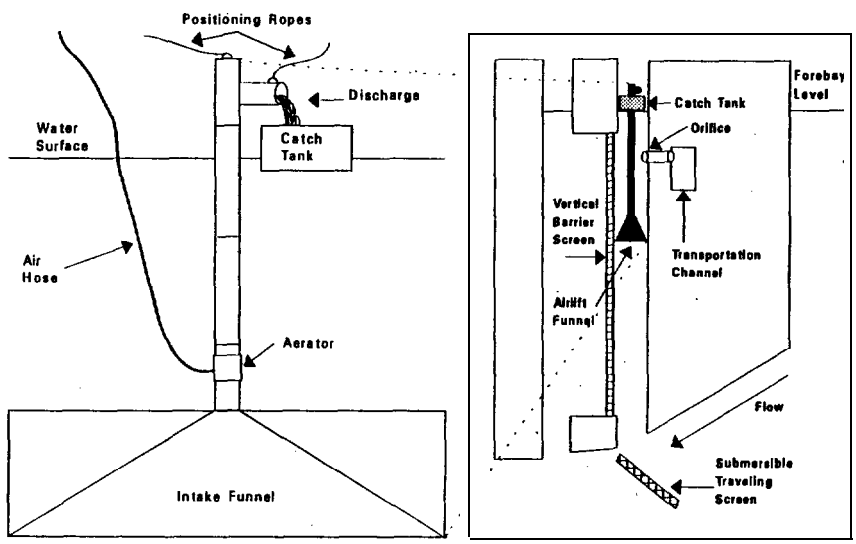


Figure 2. Components of a funnel airlift system. The inset shows its location within John Day Dam.

Approximately 40 fish at a time were then preanesthetized with about 67 mg/L. of a Benzocaine/ Alcohol solution, using the method

described by Mathews et al. (1985). After 21 June MS-222 was used as the preanesthetic instead of a Benzocaine/Alcohol solution. Once anesthetized, fish were net-transferred to the examination trough which contained about 13mg/L of Tricaine (MS 222) to minimize stress during examination. Fish were then placed .in a recovery tank and eventually routed through a PIT tag detector and back to the bypass system. All fish holding containers have a constant exchange of river -water. Except for periods of maintenance, unit 3 was in continuous operation, though turbine loading was variable through the sampling season.

BONNEVILLE DAM

Between 10 March and 31 October, samples were collected in the bypass channels of the first and second powerhouses (PH1 & 2) using the downstream migrant traps (DSM1 & 2) at Bonneville Dam. The DSM trap operation is described by Gessel (1986) for the first powerhouse,. and by McConnell and Muir (1982),. and Krcma et al. (1984), for the second powerhouse.

First **Powerhouse**

The bypass channel of PH1 was sampled 24 hours per day. Samples are collected by positioning an aluminum tank at the end of the channel and then diverting the fish into it **via a** wedge wire screen flume (Figure 3). Samples were collected hourly, from 0700hrs to 0700hrs, seven days per week.

Sample rates were adjusted on a daily basis depending on **Smolt** numbers, and were generally set from 6 to **12** minutes per hour (10-20%) throughout the migration season. The submersible traveling screens (STS) that guide fish into the bypass **system** were not removed for the summer migration as they were in 1993, resulting in a more accurate and consistent passage index for subyearling chinook this year. Sample **time** was-split into two samples Of equal duration per hour. During periods of high **Smolt** passage, the sample rate was adjusted on an hourly basis to a minimum of 1 minute per hour as necessary to avoid overcrowding the trap. Enroute to the recovery tank, sampled fish passed through a PIT tag detector.

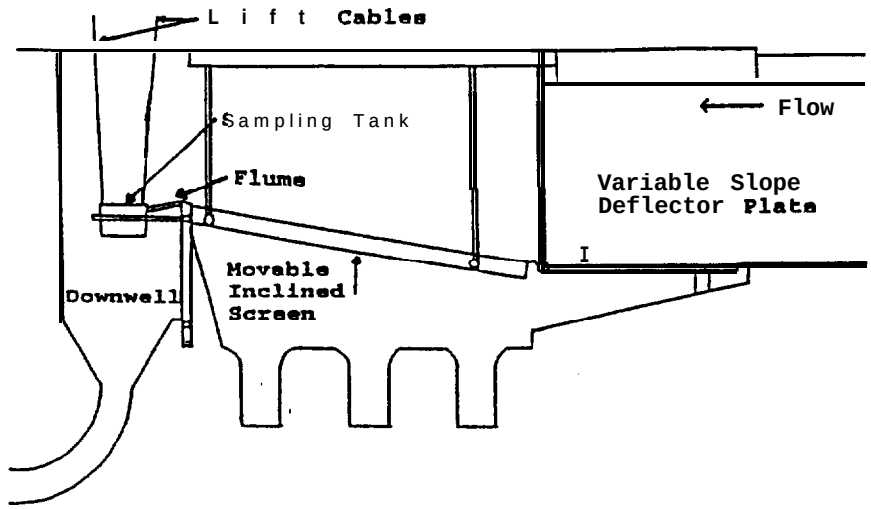


Figure 3. Inclined screen sampling system in the bypass channel of the first powerhouse at Bonneville Dam.

Second Powerhouse
As in previous years, sampling in the second powerhouse was limited to subsampling for fish condition. The DSM#2 was operated up to -24 hours per day, three days per week (M,W,F), to obtain a representative sample. The DSM#2 sampler operates at a fixed 10% sample rate. Diverted fish were held in raceways until they were examined.

At both sampling locations, fish were net-transferred directly from the holding tanks to the sorting troughs, which contained about 42mg/L of Tricaine (MS-222). After examination, fish were placed in recovery tanks and eventually routed back to a bypass channel.

DATA COLLECTED
The following is a list of data transmitted to the FPC at the end of each 24 hour sample day, from John Day and Bonneville.

1) species specific hourly and daily sample totals
2) brands and fin clips
3) descaling, general fish condition and mortality
4) length frequencies by species
5) river, powerhouse, turbine (JDA Unit 3) and spill flow data
6) PIT tag detection at both sites and recapture data at JDA

RESULTS AND DISCUSSION

Results of the Smolt monitoring activities at John Day and Bonneville Dams are summarized in Table 1 for the 1994 field season. Three types of fish counts are presented in the table:

1) Total Sample, actual handled fish counts.

2) Estimated Collection, total sample counts adjusted for sample rate. This only affected John Day from 21 July to 30 July.

3) Estimated Fish Passage Indices (FPI), estimated collection counts expanded by the proportion of flow through the sampled unit or powerhouse to adjust for daily fluctuations in project operations.

As stated in the Fish Passage Center Annual Reports, estimated Fish Passage Indices (FPI) are used as relative indicators of population abundance, and assumes that fish pass through spill and powerhouse units in numbers proportional to the flow through those passage routes. Indices are not estimates of total daily passage, but rather a relative measure of how the migration is progressing over the season for a given species.

'Since monitoring at John Day and Bonneville generates hourly as well as daily catch data, fish passage indices can be estimated by two methods;

Hourly Resolution FPI divides hourly collection totals by the proportion of total river flow through the sampled unit or powerhouse for that hour, then sums hourly passage indices for the daily total FPI.

Daily Resolution FPI divides daily collection totals by the proportion of total river flow through the sampled unit or powerhouse for the day, to get the daily FPI total.

All other SMP sites only produce daily FPI's, so the Daily method is retained at John Day and Bonneville for comparison, but the hourly method tends to more accurately reflect fish passage.

TABLE 1. SUMMARY OF 1994 SMOLT MONITORING ACTIVITIES AT JOHN DAY AND BONNEVILLE DAMS.

SPECIES	SITE	TOTAL SAMPLE	TOTAL PIT TAGS	TOTAL BRANDS	DAILY COLLECTION.[1]	DAILY FPI[2]	HOURLY COLLECTION	HOURLY FPI[3]
YEARLING CHINOOK	JOHN DAY (3B)	34,071	215	265	34,199	446,854	34,199	455,553
	BONNEVILLE PH#1	34,362	53	55	248,741	779,713	242,624	789,593
	BONNEVILLE PH#2[4]	4,172	---	7	---	---	---	---
SUBYEARLING CHINOOK	JOAN DAY (3B)	75,164	23	830	121,272	1,207,368	121,272	1,150,694
	BONNEVILLE PH#1	125,967	11	187	1,360,832	3,607,383	1,361,893	3,810,943
	BONNEVILLE PH#2	5,703	---	20	---	---	---	---
WILD STEELHEAD	JOHN DAY (3B)	7,604	25	---	7,604	96,800	7,604	99,845
	BONNEVILLE PH#1	3,730	4	0	29,796	93,520	29,422	99,490
	BONNEVILLE PH#2	218	---	0	---		---	---
HATCHERY STEELHEAD	JOHN DAY (3B)	14,454	211	416	14,457	189,420	14,457	196,281
	BONNEVILLE PH#1	3,981	19	27	33,827	105,693	33,233	112,506
	BONNEVILLE PH#2	279	---	0	---		---	---
COHO	JOHN DAY (3B)	11,385	---	---	11,413	151,135	11,413	159,173
	BONNEVILLE PH#1	22,378	---	---	201,310	626,443	205,520	699,119
	BONNEVILLE PH#2	2,678	---	---	---		---	---
SOCKEYE	JOHN DAY (3B)	7,260	5	---	7,270	96,621	7,270	101,105
	BONNEVILLE PH#1	2,965	5	0	27,945	87,146	29,845	106,584
	BONNEVILLE PH#2	400	---	0	---	---	---	---
SEASON TOTALS	JOHN DAY (3B)	149,938	516[5]	1511	196,215	2,188,198	196,215	2,162,651
	BONNEVILLE PH#1	193,383	105[6]	269	1,902,451	5,299,898	1,902,532	5,618,235
	BONNEVILLE PH#2	13,450	---	27	---	---	---	---

Data Source: Fish Passage Center and the PTAGIS data base.
[1] Daily Collection= Sample # adjusted by sample rate at Bonneville Dam.
[2] Daily FPI= Daily collection counts divided by proportion of river flow through sample unit.
[3] Hourly FPI= Hourly collection counts divided by proportion of river flow through sample unit.
[4] PH#2 sampled for fish condition only.
[5] Does not total 516 because 37 chinook were of unknown run type.
[6] Does not total 105 because 13 chinook were of unknown run type.

JOHN DAY DAM

Sampling Season

The 1994 sampling season at John Day ran from 4 April to 30 September. Monitoring in October was dropped this year due to low fish numbers for October in previous years, and to cut costs.

Unit 3 was out of service a total of 69 hours representing 1.6% of the 1994 season (Table 2). This is less than half of the time lost to unit 3 shutdown during the 1993 season (190 hours or 3.8% of the season). Only 10.5 hours of sampling were lost due to airlift shutdowns which amounted to 0.2% of the entire season. See Appendix A, Table 3 for details on biased sample days.

On 16 July, high water temperatures at McNary Dam caused large numbers of fish to die plugging the main dewatering screen which supplies water to the evaluation facility. They were forced to release 200,000 fish being held for transport and operate in an emergency full bypass mode from 17 July to 28 July. To reduce handling on these fish at John Day Dam, subsampling was initiated on 21 July and continued to 30 July. The fish handled on sampled hours were used to estimate the number of fish collected on bypassed hours. By 30 July most of these fish had passed John Day and normal sampling resumed. Mortality estimates at McNary during this incident were in the 100,000 range.

Sample Numbers, Collection Estimates and Fish Passage Indices

The total number of fish handled at John Day in 1994 was 149,938. This is about 20% fewer fish than were handled in 1993. A breakdown by species can be found in Table 1.

Sample numbers for all spring migrants were between 31% and 88% of the sample numbers captured last season. Hatchery steelhead and wild sockeye sample numbers were down the most, only 32% and 48% of last years numbers, respectively. Subyearling chinook sample numbers were 182% of the 1993 numbers due mostly to the emergency bypass operation at McNary Dam described above. The bypass occurred during the peak passage season for subyearling chinook. and dramatically increased sample numbers for about two weeks. The collection estimate for subyearlings during this period was 71,657 (59% of seasonal total). Only 25,380 fish were actually handled during this period, the rest, an estimated 46,277, were released directly into the juvenile bypass channel.

Collection numbers are divided by the proportion of river flow through the sample unit to get a Fish Passage Index (FPI). The "daily" expansion method index total for 3B was 2,188,198, about 73% of the 1993 "daily" FPI of 2,955,731. The "hourly" method generated an index total of 2,162,651, or about 75% of the 1993 "hourly" FPI of 2,892,631. In 1994, the two methods differed by only about 1%.

Flows and Spill

The 1994 spring (April & May) flows were much lower than in 1993, averaging 182.5 kcfs versus 229.9 kcfs last year. The spring peak river flow was also much smaller at 240 kcfs on 11 April compared to last years 18 April peak of 400.3 kcfs. For June and July, River flow averaged 171.8 kcfs versus 192.8 kcfs last year. Flows continued to fall throughout the summer averaging only 81.5 kcfs for August and September (Figure 4).

Over-generational spill averaged 23% of daily average river flow from 9 May to 6 June and comprised 7.6% of daily average river flow during the period specified in the Fish Spill Memorandum of Agreement, 7 June through 22 August. Authorized spill under this agreement is 20% of instantaneous flow for 10 hours per day (2000h - 0600), which equals 8.3% of the daily average flow.

The daily average discharge through the sampled unit (3B) ranged between 8.1 and 17.4 kcfs over the season. The daily variance was minimal, Figure 4a.

Seasonal Passage Patterns

Seasonal passage patterns for each species are presented in Figure 4 and 4a. Peak passage for all spring migrants, except yearling chinook, occurred during the last half of May. Yearling chinook passage was more protracted with small peaks from the first of May through mid June. The lower flows in 1994 extended the migration period for all spring migrants except coho. The middle 80% of the coho run took 4 fewer days to pass John Day in 1994 than in 1993, 18 versus 22, respectively, (Appendix A, Figure 1).

Subyearling chinook passage was very condensed and occurred during the last half of July, with the middle 80% passing John Day in just 26 days, compared to 58 days last year. Again, this was a direct result of the McNary Dam emergency bypass operation. For this reason, 1994 subyearling chinook 10, 50, and 90% passage dates do not reflect normal migration timing. A graphic comparison of historical passage dates for John Day is presented in Appendix A, Figure 1. Estimated 10, 50 and 90% passage dates by species are listed in Table 2 below.

Table 2. Estimated 10, 50, and 90 percent passage dates for John Day Dam, 1994.

Species	10%	50%	90%
Yearling Chinook	5/02	5/22	6/18
Subyearling Chinook	7/08	7/22	8/02
Wild Steelhead	4/27	5/19	5/26
Hatchery Steelhead	5/09	5/24	6/01
Coho	5/12	5/18	5/29
Sockeye	5/11	5/24	6/05

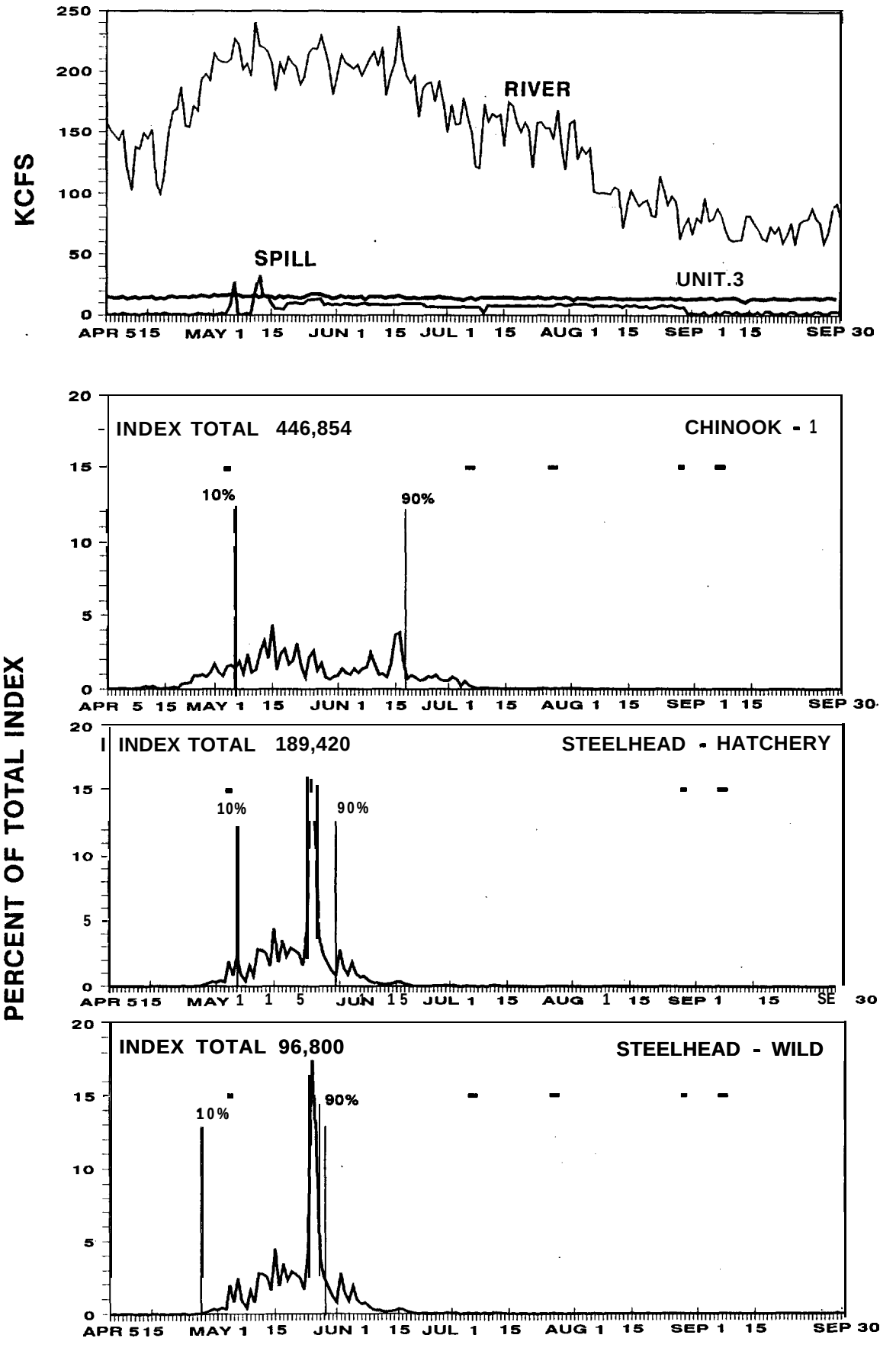


Figure 4. Seasonal passage patterns and average flows for John Day Dam, 1994.

■ Indicates sample days less than 24 hours.

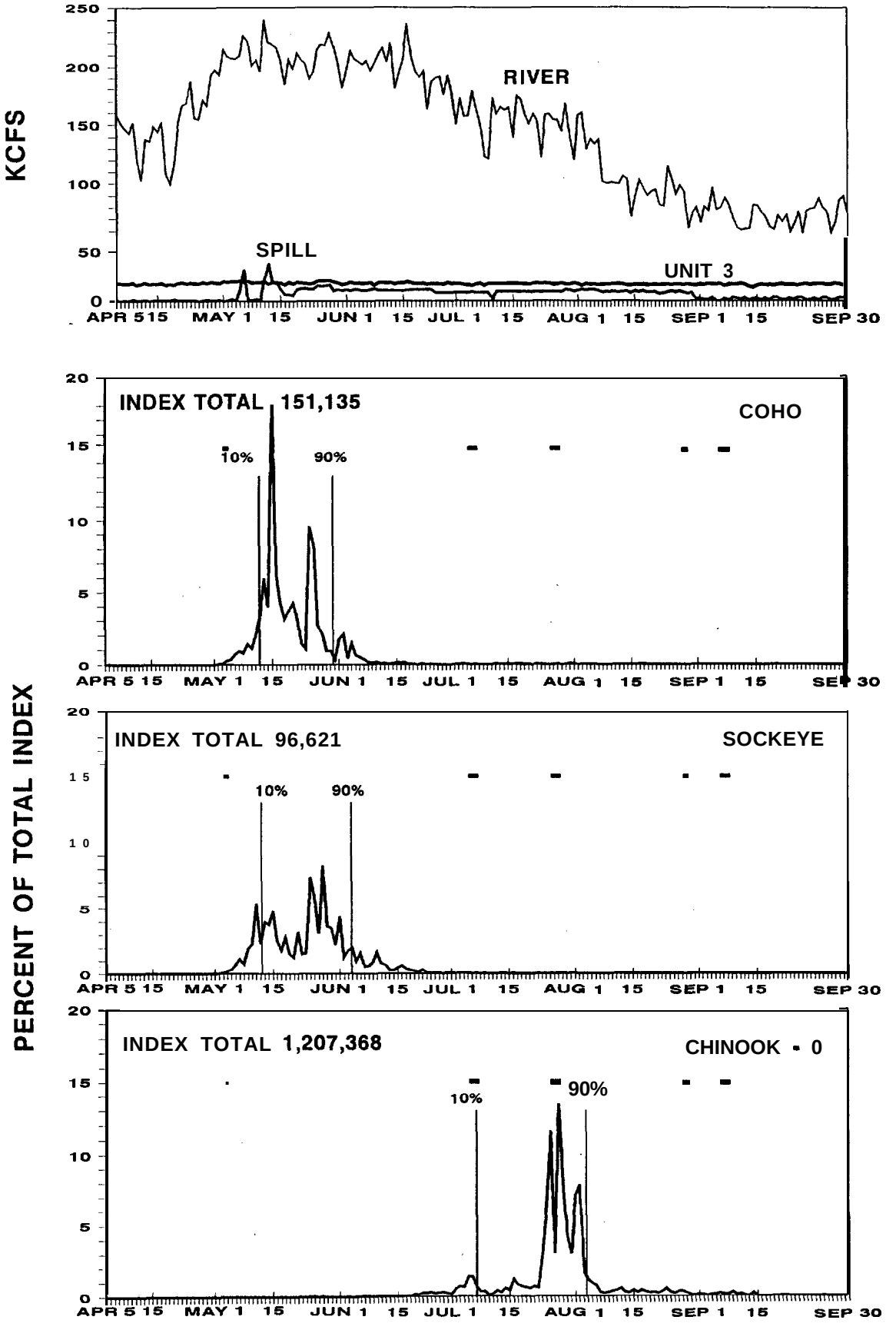


Figure 4a. Seasonal passage patterns and average flows for John Day Dam, 1994.

■ Indicates sample days less than 24 hours.

Diel passage patterns were quite consistent over the season and with previous years in that the majority of passage (63 to 93 percent) occurs at night, between the hours of 8pm and 6am (2001-0600 Pacific Daylight Time) as shown in Table 3.

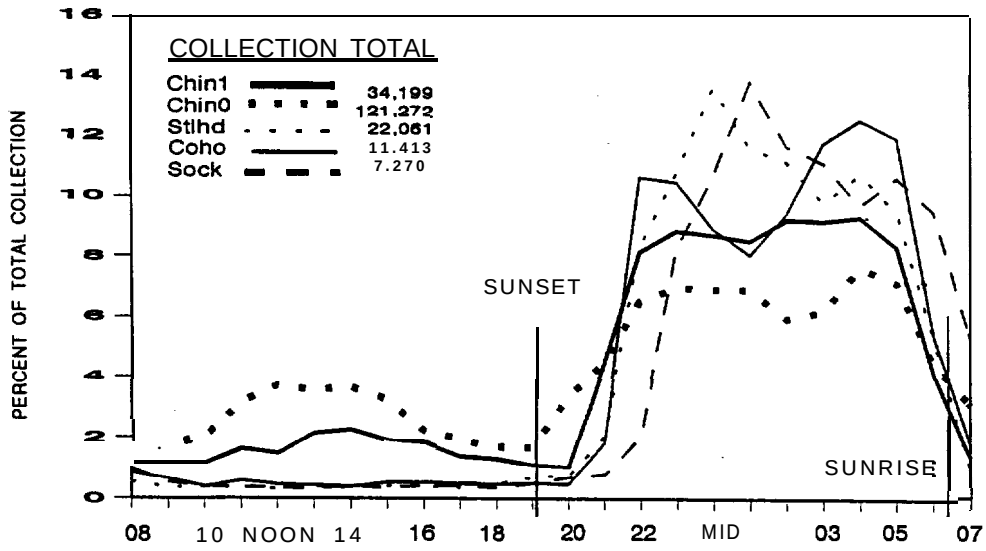


Figure 5. Seasonal diel passage pattern at John Day Dam, 1994.

Passage for all species increased after dark, about 2000 hours, and stayed elevated until sunrise. Steelhead and sockeye passage peaked at midnight and 0100 hrs, respectively. Peak passage for coho, yearling and subyearling chinook occurred later at 0400 hrs. This is considerably different than the 2100 or 2200 hr peak seen for these species in previous years. Additionally, there were uncharacteristic daytime peaks for yearling and subyearling chinook from about 1000 hrs to 1600 hrs, (Figure 5). Overall nearly 71% of all fish were sampled at night (2001-0600).

Table 3. Total percent passage for day and night hours.

Species	% Day (0601-2000)	% Night (2001-0600)
Yearling Chinook	21.2	78.8
Subyearling Chinook	36.8	63.2
Steelhead - Wild	9.5	90.5
- Hatchery	20.5	79.5
Coho	8.8	91.2
Sockeye	77.0	93.0
Combined	29.1	70.9

Percent of night time passage is presented in Appendix A, Figure 2. There is considerable variability in the percent of night passage day to day, but overall the diel pattern is very consistent.

Fish Condition

All sampled fish were categorized as either normal, descaled or dead. A fish was considered normal if less than 20% of the scales on one side were missing, descaled if *more* than 20% were missing. Overall descaling and mortality percentages for 1994 are compared to 1993 and the historical averages in Table 4.

Table 4. Overall descaling and mortality at John Day Dam in 1994 compared to 1993 and the historical average, (1985-1993).

	Chinook 1		Chinook 0		STHD-W		STHD-H		Coho		Sockeye	
Year	%D	%M	%D	%M	%D	%M	%D	%M	%D	%M	%D	%M
1994	6.8	4.7	3.3	6.7	3.8	1.1	12.7	3.8	4.0	2.5	10.1	2.1
1993	10.6	4.7	3.6	5.5	3.4	1.8	12.6	2.0	5.1	0.8	11.3	2.7
85-93	9.4	2.4	3.5	3.1	5.0	1.0	8.7	1.1	5.9	0.7	9.1	1.1

In 1994, overall descaling rates were lower or similar to 1993 and historical averages for yearling chinook, subyearling chinook, coho, and sockeye. Wild steelhead descaling was slightly higher. than 1993 levels but lower than the historical average. Hatchery steelhead descaling was about the same as last year but higher than the historical average (Table 4, Figure 6). Daily descaling rates for the 1994 season are presented in Appendix A, Figures 3 and 4. For a graphical comparison of descaling for all years at both sites see Appendix D, Figure 1.

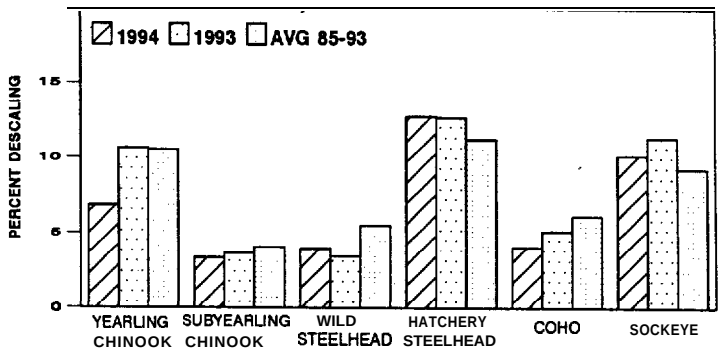


Figure 6. Total descaling for 1994, compared to 1993 and the 85-93 average, John Day Dam.

Mortality rates were as high or higher than any year since 1985 for yearling chinook, subyearling chinook, hatchery steelhead and coho. Wild steelhead and sockeye had slightly higher mortality rates last year. Mortality rates for all species were higher in 1994 than their respective historical averages, (Table 4, Figure 7). Excluding sample days when less than 35 fish

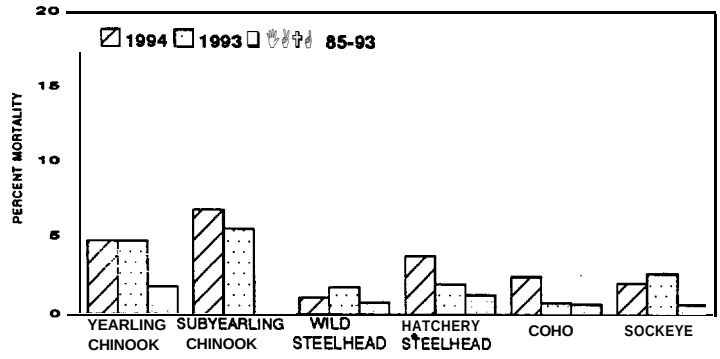


Figure 7. Total Mortality for 1994, compared to 1993 and the 85-93 average, John Day Dam.

were sampled, mortality peaked in late May for all species except sockeye, which peaked in mid June, (Appendix A, Figure 3). Several days with extremely high subyearling mortality rates (13% to 35%) occurred while McNary was in emergency bypass mode, (Appendix A, Figure 4). The high river temperatures, low river flows, and a high incidence of columnaris symptoms (8.7), probably account for those high mortality rates.

In an attempt to improrve fish condition by keeping trash racks clean, all trash racks were raked prior to April 1. Every other week thereafter, through mid June, Units 1 - 5 and three other units were raked. Units 1 - 5 were chosen because debris and fish passage are heaviest there. The other three units were chosen based on fish condition from gatewell dipnetting. One gatewell from the middle section (units 6 - 10), and one from the north end (units 11 - 16) of the powerhouse were dipped. Three units from the section with higher descaling, based on the dipnet results, were then raked. The combined dipnet totals were; yearling chinook: 847, wild steelhead: 288, hatchery steelhead: 643, coho: 41, and sockeye: 94, (Figure 8). Regular inspections of the airlift funnel for debris plugs were also conducted during this period. One minor debris plug was removed on 8 May. Bi-monthly screen and orifice inspections by the CoE found only normal debris accumulation on the VBS below the funnel.

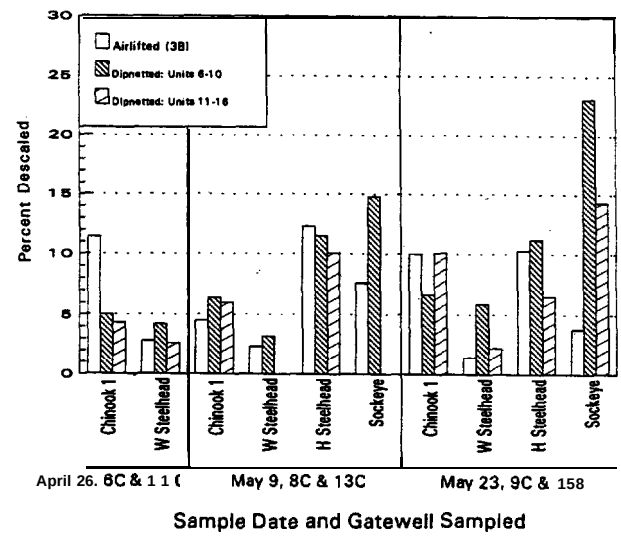


Figure 8. Descaling Rates of Juvenile Salmonids Airlifted and Dipnetted at John Day Dam. Dipnetted fish were collected from 0000 to 1000 or 1100 and compared to airlifted fish from the same time period.

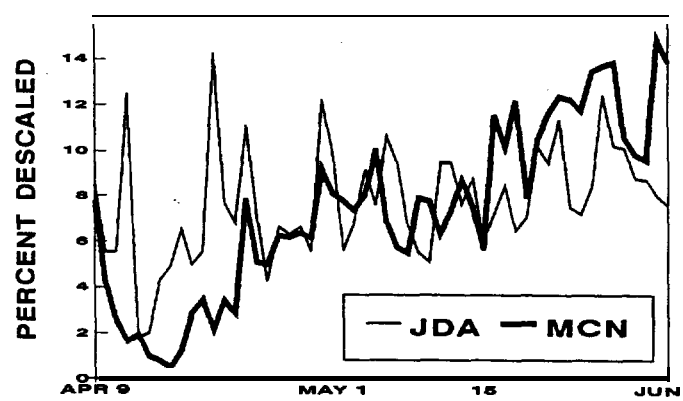


Figure 9. Spring descaling rate comparison, all species combined, at John Day and McNary Dams, 1994.

The dipnet results could also be compared with the airlift samples to verify that the airlift was providing samples representative of "river run" fish condition, (Figure 8). With the exception of yearling chinook on the April 26 dipnetting, airlifted fish condition was similar to dipnetted fish condition. This suggests that airlifted fish condition was representative of the "river run" fish condition. Also, a comparison to McNary descaling (Figure 9) showed similar descaling at that upriver project from the end of April through May.

Subsampled Fish Condition

Detailed fish condition information was taken on a subsample (target n=100) of each species three times per week. Approximately 14,981 smolts were examined this season for partial descaling (between 3 and 20% scale loss on a side), injuries, parasites and obvious disease symptoms including gas bubble disease. The results are presented in Appendix A, Table 2.

Partial descaling ranged from 8.1% on subyearling chinook to 24.2% for hatchery steelhead, and averaged 12.8% overall. Hatchery steelhead had the highest rates of operculum/gill injuries (1.9%), external fungus symptoms (3.9%), and bird marks (15.1%). Wild steelhead had the highest rate of parasitic infection (2.2%). Subsamples of subyearling chinook had the highest rates of columnaris infection at 8.7% overall and 12.8% (293 of 2,290) for the 30 July through 10 September period, when water temperatures were peaking, averag-ing about 70^0 F.

The incidence of columnaris symptoms on morts was also recorded during this period. Of the 1,618 morts examined, 1,004 or 62.1% had visible Columnaris symptoms. On 19 July Phyllis Barney, a pathologist with The Lower Columbia River Health Center examined 7 subyearling morts and found 6 to be heavily infected with columnaris.

During the spring of 1994 a spill program to improve migrating conditions for smolts was initiated. Concern over high levels of spill causing lethal dissolved gas levels prompted an expanded.Gas Bubble Trauma (GBT) symptom monitoring program. Smolt monitoring crews were asked to look for internal GBT symptoms in addition to the external exams being conducted. Between 17 May and 20 June, 30 hatchery steelhead were examined every other day for gas bubbles in the blood, gill filaments, lateral line groove and internal organs. Of the 485 fish sacrificed, 9% had bubbles in the internal organs, 28% had bubbles in the gill filaments, and 46% had bubbles in the lateral line groove.

Several factors detracted from the utility of the data collected from this monitoring program: 1) the lack of planning prior to data collection, 2) methodologies were added or modified throughout the monitoring period 3) training of monitoring personnel in handling

and examination techniques was not standardized adequately between sampling sites. In summarizing the program Fish Passage Center stated that "the results of the internal monitoring were not interpretable" (FPC 1994).

No external gas bubble disease symptoms were observed in any species this year, (Appendix A, Table 2).

Freeze Brands and PIT Tags

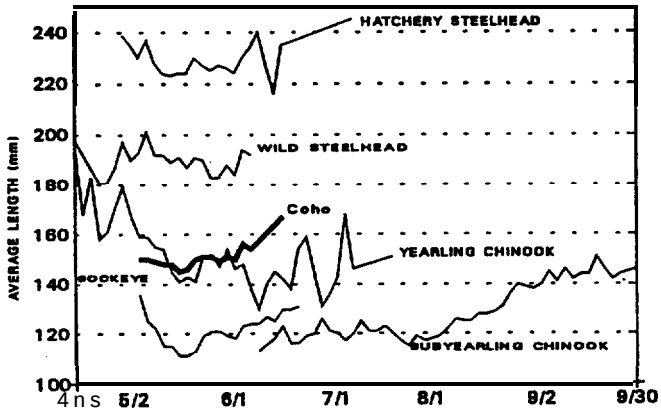
A total of 1,511 brands were recovered this season, about a third of last years 4,515. Subyearling chinook had the most brands (830), followed by hatchery steelhead (416) and yearling chinook (265). Fish branded at McNary were given a "quality" rating upon recovery at John Day. That information was sent back to the McNary marking program for use in their quality control program. The large reduction in brand recoveries was due to the elimination of the spring marking program at McNary and operating 1 airlift instead of two.

The number of PIT tagged fish detected in 1994, (516) was 82% of the number detected in 1993 (632). Almost 80% of the PIT tags detected at John Day were from hatchery fish. Yearling spring chinook and steelhead were 42% and 46% of all detections, respectively, (Table 1).

A PIT tag diverter and recapture station were installed on 19 May. This equipment enabled us to collect length, weight, and condition information from individual fish. Out of 386 smolts detected, 333 were diverted, for a diversion efficiency of 86.3%. A summary of the PIT tags detected, and travel time estimates are in Appendix A, Table 1.

Length Frequency

Length frequencies are presented in Figure 10 to show relative size differences and trends throughout the season. Other than wild steelhead, patterns are primarily the result of different hatchery stocks.



Firgure 10. Average length of juvenile salmonids at John Day Dam, 1994. Samples< 10 were omitted.

Brand Recovery Tests

Only a few tests to evaluate brand recognition and recording eff-iciency of fish handlers at John Day Dam were conducted in 1994. The test consisted of netting the fish out of the recovery tank and reprocessing. Those results were compared to the employees results. This approach eliminated the labor

intensive and stressful technique of branding fish and seeding the collection tank as in past years. The results are presented in Table 5.

Table 5. Results of the quality control tests.

Species ID	Condition ID	Brand ID	# Correct/ # Possible	Overall Accuracy
195/200	179/200	0/2		
97.5%	89.5%	0%	374/402	93.0%

Fry Incidence

Only 47 fry were captured from 3B in 1994. This is 3.5% of the 1993 total of 1,317. Fry were most abundant the last half of May.

Adult Catch

A total of 74 adult salmonids were captured by the airlift system this season, (Table 6). This is less-than half of the 168 caught in 1993. The biggest decline was for steelhead, from 145 in 1993 to 52 in 1994.

Table 6. Adult Salmonid Fallbacks at John Day Dam, 1994.

Gatewell	Chinook	Sthd-W & H	Coho	Sockeye	Total
3B	15	52	2	5	74

Incidental Catch

A summary of the seasonal total incidental catch of non-salmonid species is presented in Appendix C, Table 1.

American shad (Alosa saoidissima) were by far the most common incidental species captured at John Day Dam this season (Appendix C, Figure 1). The catch of juvenile shad for 1994 was 61.9% (111,418) of that caught in gatewell 3B for 1993 (180,088). This is mostly due to eliminating the month of October from the sampling season this year. Previous years data shows that the shad run continues well into October and beyond.

The total number of juvenile Pacific Lamprey (Entoshpenus tridentatus) captured in gatewell 3B decreased this year to 3,250, 74.7% of last year's catch of 4,348.

BONNEVILLE DAM

Sampling Season

The sampling season at Bonneville was shortened by one month this year compared to previous years. November was dropped due mostly to minimal fish passage, based on previous years, and as a cost cutting measure. The Submersible Traveling Screens (STS's) were not removed this year for the subyearling chinook migration, as in 1993.

At PH1 a total of 55 hours of sampling were missed, about 1% of the season. Thirty four hours (62%) were due to a recurring cable problem on the single shaft hoist system. Attempts to correct the problem this year consisted of trying two different cables and installing swivel attachments for the cable. One cable was a prestressed stainless steel, the other a standard steel cable. The stainless steel cable would fray after about 3 weeks of use. The steel cable would twist and knot if given any slack requiring replacement before the trap could be safely operated. The swivels compensated for some of the twisting, but did nothing to prevent the knotting if cables were slacked. For a complete list of biased sample days due to missed samples, see Appendix B, Table 3.

The PH2 sampler was out of service from 3 June to 6 June due to an electrical problem with the electric motor on the 10% sampler. Also, the DSM#2 was taken out of service during peak passage periods of Spring Creek National Fish Hatchery releases.

Sample Numbers and Passage Indices

In 1994, the third year of 24 hour monitoring in the First Powerhouse **(PH1)**, 193,383 juvenile salmon and steelhead were sampled from.11 March to 31 October. This resulted in an expanded (by sample rate) collection estimate of 1,902,451 using the daily method, and 1,902,532 using the hourly method. These collection estimates were further expanded by the percent of river flow through PH1 to generate Fish Passage Indices (FPI). The "Daily" expansion method generated an index total of 5,299,898 and the "Hourly" expansion method generated an index total of 5,618,235 (Table 1). Both the "Daily" and "Hourly" FPI's were reduced from those recorded in 1993 for all species. Much lower flows, more transport and a shorter season likely contributed to the. lower FPI's.

The two methods varied by as little as 1% for yearling chinook and as much as 18% for sockeye. For all species, the "Hourly" method produced a larger index total. The "Hourly" expansion method may more accurately reflect passage because it accounts for the changing flow distribution by calculating indices hourly and summing for the day.

At the **Second Powerhouse** a total of 13,450 smolts were sampled for fish condition and brand information. This data was used to monitor the condition of the bypass system. No fish collection or passage indices were calculated for this site.

Flows and Spill

In 1994, flows at Bonneville were lower and more level than in 1993. River flow averaged 171.4 kcfs from 11 March to 31 May, compared to 223.1 Kcfs for the same period last year. River Flow peaked on 7 May at 231.9 kcfs, much lower than the 395.2 kcfs peak on 18 May in 1993. From 1 June through July, river flow averaged 174.4 kcfs, compared to 1993's average of 198.6 kcfs for the same period. Flows continued to decline throughout the summer and fall averaging 89.0 kcfs between 1 August and 31 October, considerably lower than last years average of 107.4 kcfs, for the same period.

Spill for the 17 March release of 7.5 million tule fall chinook from Spring Creek National Fish Hatchery (SCNFH) averaged about 45% of river flow for the period 19 March through, 26 March. Spill resumed on 16 April to flush the 14 April SCNFH release of 4,143,596 tule fall chinook past the project. From 16 April to 26 April spill averaged about 50% of river flow. Spill continued at an average rate of 77 kcfs through July, then dropped to an average of 41.8 kcfs through 23 August when spill ceased.

Spring (11 March to 31 May) discharge for PH2 averaged 39.7 kcfs. This average fell only slightly to 35.8 Kcfs for the summer period 1 June to 31 July. For the late summer and fall period (1 July to 31 October) PH2 discharge averaged only 11.5 Kcfs. PH2 discharge following the first two spring Creek releases (17 March and 14 April) fell to just 7.3 and 9.7 kcfs, respectively. *For the 19 May release, no reduction in PH2 discharge occurred, averaging 43.8 kcfs for the period when Spring Creek fish were expected to pass Bonneville. A reduction in PH2 discharge following a Spring Creek release is thought to increase the number of those fish passing the project via the spillway.

Seasonal Passage Patterns

Fish passage patterns for the first powerhouse are presented in Figure 11 and lla. Estimated 10 and 90 percent passage dates for each species are listed in Table 7. A comparison of historical passage dates at Bonneville is presented in Appendix B, Figure 1.

Passage of spring migrants was more protracted than in 1993, as was river flow. The bulk of the yearling chinook passage shifted from the last half of May in 1993, to the first half of May in 1994. The middle 80% of all other spring migrants took nearly twice as long to pass Bonneville in 1994 as in 1993; hatchery steelhead: 32 vs 16; wild steelhead: 33 vs 23; coho: 27 vs 22; sockeye: 20 vs 11, (Appendix B, Figure 1).

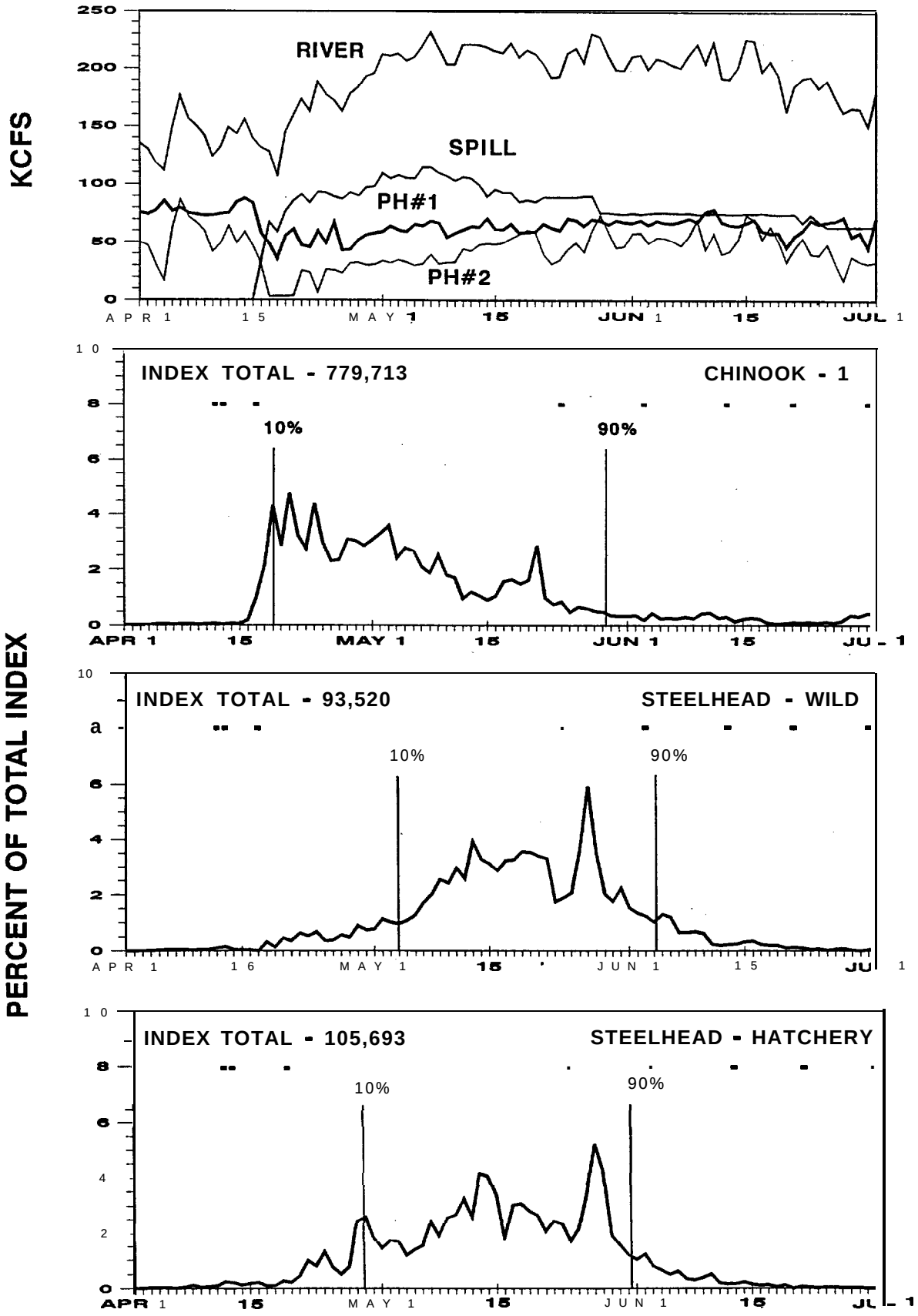


Figure 11. Seasonal passage patterns and average flows for Bonneville Dam, 1994.

▮ Indicates sample days less than 24 hours.

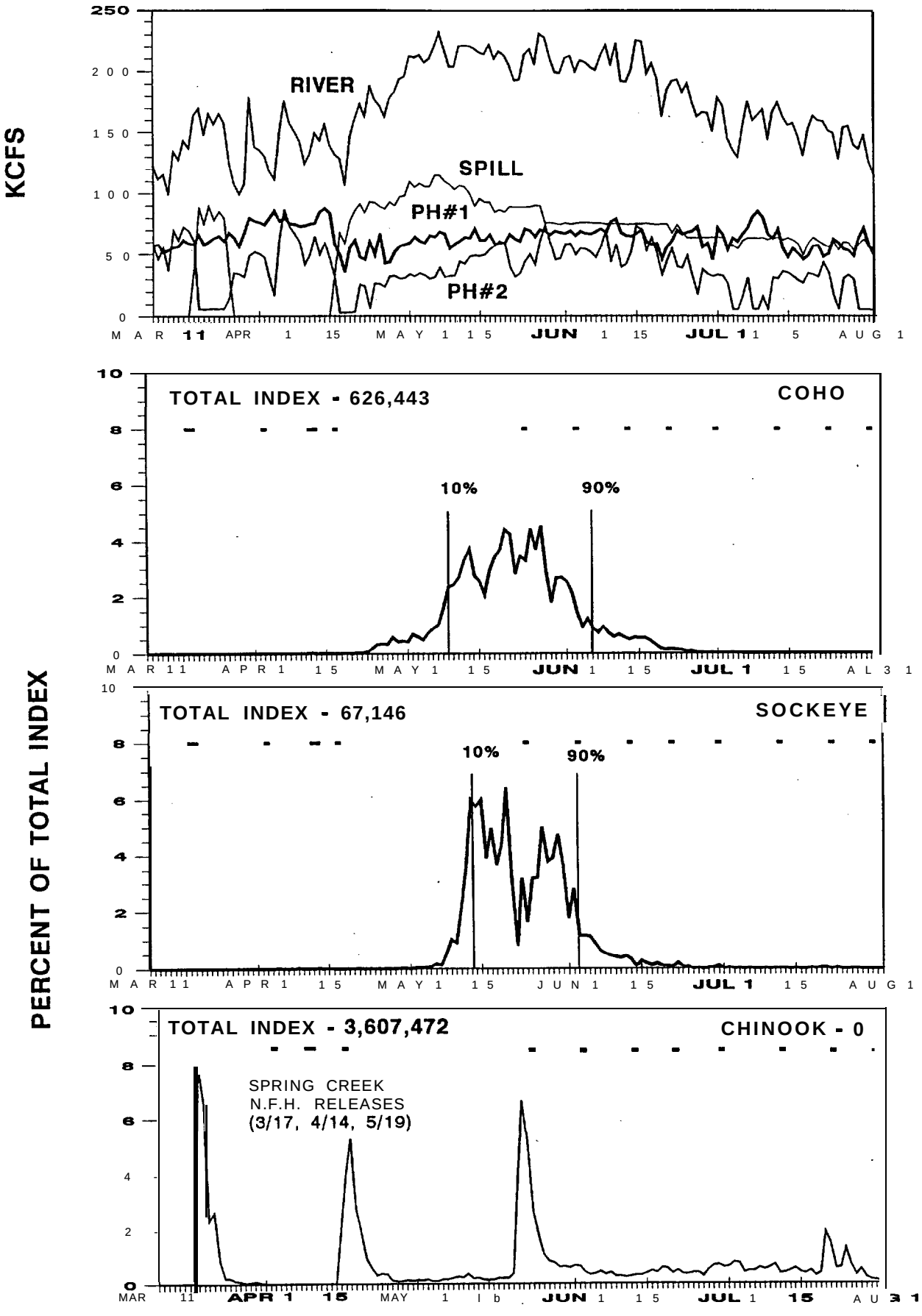


Figure 11a. Seasonal passage patterns and average flows for Bonneville Dam, 1994

▮ Indicates sample days less than 24 hours.

The spring passage pattern (before June 1) for subyearling chinook mainly represents large releases of SPNFH "tule" stock into the Bonneville pool (Table 8). For this reason 10 and 90% passage dates were not calculated for these fish.

Table 7. Passage dates at PH1, Bonneville, 1994.

Species	10	50%	90%
Yearling Chinook	4/19	5/2	5/31
Subyearling Chinook- "Brights"	6/9	7/8	7/26
Steelhead - Wild	4/28	5/15	5/31
Hatchery	5/3	5/20	6/4
Coho	5/9	5/23	6/5
Sockeye	5/13	5/21	6/2

The summer passage pattern for subyearlings (after June 1) mainly represents that portion of the run which is upriver bright stock. This year the STS's were not removed and sampling continued as scheduled. The 10, 50, and 90 percent passage dates, and the middle 80% passage time (47 days) are very similar to previous years for subyearling chinook, (Appendix B, Figure 1).

Table 8. 1994 Spring Creek National Fish Hatchery releases.

RELEASE DATE	RELEASE SIZE	PEAK PH1 PASS.	AVG. RIV. FLOW (KCFS)	SPILL AS % OF RIV
March 18	6,856,282	March 19	213.3	36.3
April 15	3,978,719	April 16	156.1	45.3
May 20-21	3,694,700	May 21	356.2	37.9

Diel Passage

The diel patterns observed in our third year of 24 hour monitoring . strongly confirm the patterns observed in 1993, 1992 and by previous years "spot" diel monitoring. Peak passage for all species occurred between 2100 and 2300hrs. After 2300hrs, passage declined to lower levels but remained fairly constant until sunrise. At sunrise, there is a minor increase in passage followed by a decline in passage throughout the day (Figure 12).

The passage patterns of "tule" and "bright" stocks of subyearling chinook mirror one another closely in that both peak sharply after sunset, with a minor peak at sunrise (Figure 13). Brights peak a little later, due to a later sunsets over the migration season.

Since this is only the third year of diel monitoring at Bonneville, monthly diel passage graphs were made to look for variations in diel passage over the season. These graphs are presented in Appendix B, Figures 3-9. In general, monthly diel patterns mirror the seasonal diel passage graph. Catch numbers were adjusted in both the monthly and seasonal diel passage graphs to eliminate the affect of fluctuations in powerhouse discharge, basically showing passage under flat loaded conditions.

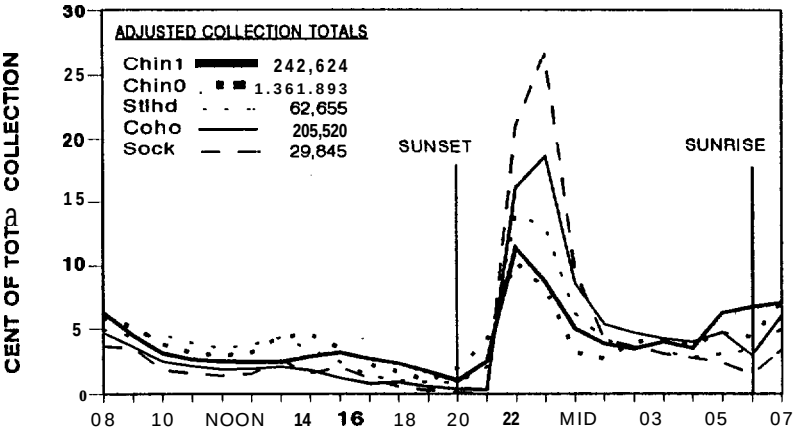


Figure 12. Seasonal diel passage patterns from PH-1 at Bonneville Dam, 1994.

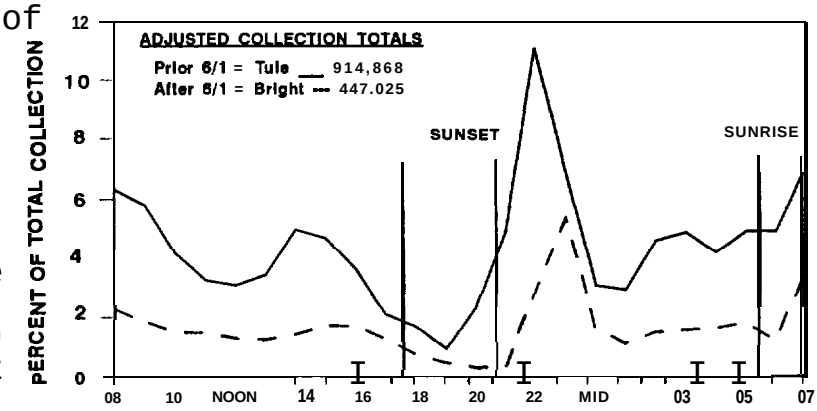


Figure 13. Seasonal diet passage patterns of subyearling chinook stocks from PH-1 at Bonneville Dam, 1994.

Table 9 lists the percent total daytime (0601 - 2000 hrs) and nighttime (2001 - 0600 hrs, Pacific Daylight Time) passage for the season at PH1. Although "Tule" subyearling chinook passage peaked at night, the majority of passage occurred during daytime hours. All other species had a greater percent of total passage during nighttime hours.

Table 9. Percent day and night passage, PH1, Bonneville 1994.

Species	Day (0601-2000)	Night (2001-0600)
Yearling Chinook	44.7	55.3
Subyearling Chinook-	45.5	54.5
Tule	51.8	48.2
Bright	47.6	52.4
Steelhead - Wild	45.4	54.6
Hatchery	44.1	55.9
Coho	30.7	69.3
Sockeye	25.4	74.6
Combined	44.9	55.1

There is considerable daily variability in the percent of nighttime passage, (Appendix B, Figure 2) but overall, the pattern is quite consistent, (Figure 12).

Fish Condition

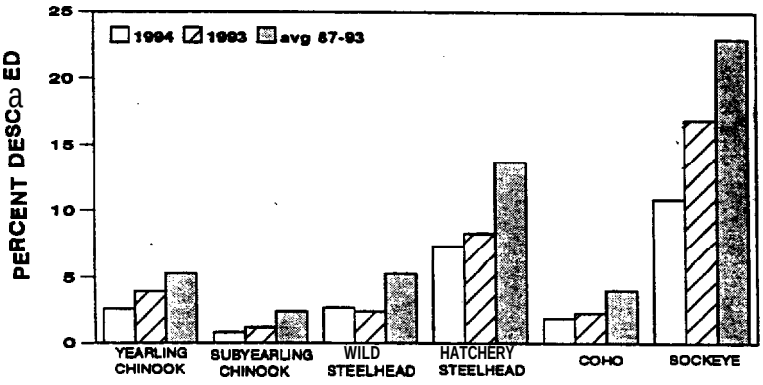
The percent of total fish that were descaled and dead in the 1994 sampling season and the comparison to 1993 and the historical average (1987-1993) are presented in Table 10 below.

Table 10. Percent descaling and mortality at Bonneville Dam, PH1.

	Chinook 1		Chinook 0		STHD-W		STHD-H		Coho		Sockeye	
Year	%D	%M	%D	%M	%D	%M	%D	%M	%D	%M	%D	%M
1994	2.6	0.2	0.8	0.5	2.8	0.1	7.3	0.1	1.9	0.1	10.8	0.1
1993	3.9	0.1	1.2	0.5	2.4	0.0	8.3	0.0	2.3	0.0	16.9	0.3
85-93	5.3	0.3	2.0	0.4	5.5	0.1	13.7	0.2	4.2	0.1	23.1	0.4

Daily descaling and mortality rates for the 1994 season at PH1 are presented in Appendix B, Figures 10 and 11.

'Except for wild steelhead, descaling rates in 1994 were lower than in 1993 and historical averages for all species (Figure 14 and Table 10). Overall descaling for sockeye was down to 10.8% in 1994, considerably better than either the 1993 (16.9%) or historical average (23.1%).



Firgure 14. Total descaling for 1994, compared to 1993 and fhe 87-93 average, Bonneville Dam.

Daily descaling rates were quite variable over the season for yearling chinook, hatchery steelhead and sockeye, (Appendix B, Figure 10). The highest mortality rate (8.9%) for chinook O's occurred on 24 July when water temperatures reached 70.4 degrees Fahrenheit. Overall mortality rates for sampled fish were less than 1% for all species.

Powerhouse 2 descaling and mortality percentages are presented in Table 11. Yearling chinook, subyearling chinook, coho, and sockeye descaling rates were nearly twice that of PH1 rates. Descaling for steelhead was similar to that observed in PH 1. Overall mortality in PH2 samples was .5 to 1.0 percentage points higher for all species.

Table 11. Descaling and Mortality from PH2 at Bonneville Dam.	CHINOOK-l	CHINOOK-0	STEELHEAD	COHO	SOCK
TOTAL SAMPLED	4,172	5,703	497	2,678	400
% DESCALED	5.1%	1.4%	7.2%	2.6%	18.8%
% MORTALITY	1.3%	2.4%	0.6%	0.7%	1.0%

Subsampled Fish Condition

Three times per week a subsample (target n= 100) of each species was examined for detailed fish condition information. Partial descaling (>3 but <20%) was the most prevalent condition, ranging as high as 22% for hatchery steelhead and 27% for wild sockeye. Bird injuries were less than 3% for all species except hatchery steelhead which had a rate of 8%. Wild steelhead had an 8% incidence of external parasites, (Appendix B, Table 2).

Gas Bubble Disease Symptom Monitoring

From 9 May to 21 June NMFS initiated a supplemental spring spill program to speed juvenile migration. The additional spill raised concern over Gas Bubble disease and more intensive monitoring was conducted during this period. External symptom monitoring was conducted daily, instead of three times per week, and microscopic internal examinations of 30 hatchery steelhead were conducted every other day.

Overall incidence of gas bubble trauma symptoms from the external examinations was less than 0.5 percent. Results of the internal examinations were not interpretable (FPC 1994). Several factors contributed to this, including: 1) inadequate planning time, 2) modified methodologies throughout the program, and 3) lack of standardizing between sites. A total of 457 hatchery steelhead were sacrificed. Results are presented as percent of total fish examined; external lateral line: 29%, internal lateral line: 94%, gill filament: 40%, internal organs: 24%. The high internal lateral line incidence may have been an artifact of the exam method. The results are presented for information only, no conclusions should be drawn from them.

Freeze Brands and PIT Tags

A total of 269 brands were detected and recorded from the PH1 samples with 90% of those found on yearling and subyearling chinook (Table 1). Steelhead account for the other 10%. This is down from 782 brands recorded in 1993.

Pit tag detections were also down from 153 in 1993 to 101 in 1994, (Table 1). PIT tag recapture details at PH1 are presented in Appendix B, Table 2.

Length Frequency

Individual fish lengths were obtained in conjunction with the fish condition subsampling described above. On average, hatchery steelhead were longer than wild, 228 and 198 mm respectively, and "bright" subyearling chinook, ere longer than "Tules", 118 and 74mm respectively (Figure 15).

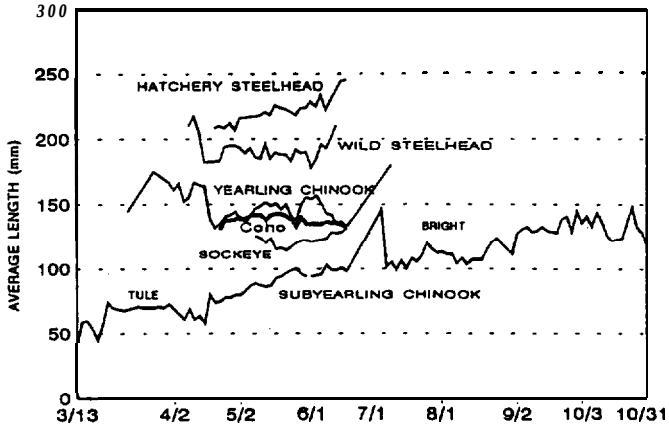


Figure 15. Average length of juvenile salmonids at Bonneyille Dam, 1994. Samples<10 were omitted.

Fry Incidence

In 1994 subyearling chinook and coho fry (<60mm) collection totals, (sample numbers expanded by sample rate) were 13,843 and 461, respectively. Approximately 1% of all-subyearling chinook were fry, this year, compared to 4.3% in 1993 and 2.4% in 1992. For coho, 0.2% were fry, compared to 0.2% in 1993 and 0.6% in 1992. The middle 80% of the chinook fry passed Bonneville between 21 March and 8 May. The middle 80% for coho passed between 7 April and 21 May.

Adult Incidence

Seven adult fish were recorded as incidentals during the 1994 season. Four of these were steelhead and 3 were chinook. Three of these fish passed through the large fish and debris separator bars and had to be removed from the tank. The other 4 fish were observed sliding across the top of the tank and returning to the bypass channel. It should be noted that because personnel spend little time observing the channel and trap area, it is possible that many more adult fallbacks pass undetected.

Incidental Catch

Incidental catch details for the season are presented in Appendix C, Table 2. There was an unusual abundance of three-spine stickleback (Gasterosteus aculeatus) this season. More were collected in 1994 (78,779) than the past 6 years combined (23,043).

American Shad (Alosa sapidissima) juvenile collection counts were present in the samples from late August through 31 October (Appendix C, Figure 2). The total juvenile shad collection count for 1994 was 252,474 which is close to the 1993 total of 297,725 but much lower than the 1992 total of 4,504,033. The large drop in shad numbers in 1993 was probably due to the removal of the STS's on June 9. In 1994 the screens were left in, but the season ended a month earlier, while shad were still abundant.

Pacific Lamprey (Entosphenus tridentatus) juveniles appeared in PH1 samples in low numbers from May through the end of the season (Appendix C, Figure 4). Collections totalled 1,074 for the year, compared to 6,204 in 1993, 526 in 1992, 4,568 in 1991 and 1,780 in 1990.

Table 12. Adult and juvenile shad collection totals at Bonneville Dam, PH1, 1989-1994.

	AMERICAN SHAD			
YEAR	ADULTS	JUVENILES	SAMPLE HRS.	
1989	3,105,300	435,441	8	
1990	4,012,000	2,934,762	8	
1991	2,363,100	1,481,768	8	
1992	3,073,000	4,504,033	24	
1993	2,154,938	297,725	24	w/o STS's
1994	1,557,549	252,474	24	

ACKNOWLEDGMENTS

Support for this monitoring project comes from the region's electrical ratepayers through the Bonneville Power Administration under the Northwest Power Planning Council Fish and Wildlife Program. The success of this program continues to involve cooperative interaction with NMFS Coastal Zone and Estuarine Studies Division and the U.S. Army Corps of Engineers on-site biologists, assistants and others who provided valuable guidance and assistance at John Day and Bonneville Dams.

We acknowledge the very capable efforts of our biologists, technicians, maintenance and contract persons; their work was vital. Key people were Mike Langeslay at Bonneville Dam, and Ritchie Graves at John Day Dam, and Doug Frantum for keeping the airlift operating and Sue Killins for keeping us "on and in" line.

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APPENDIX A
JOHN DAY DAM - 1994

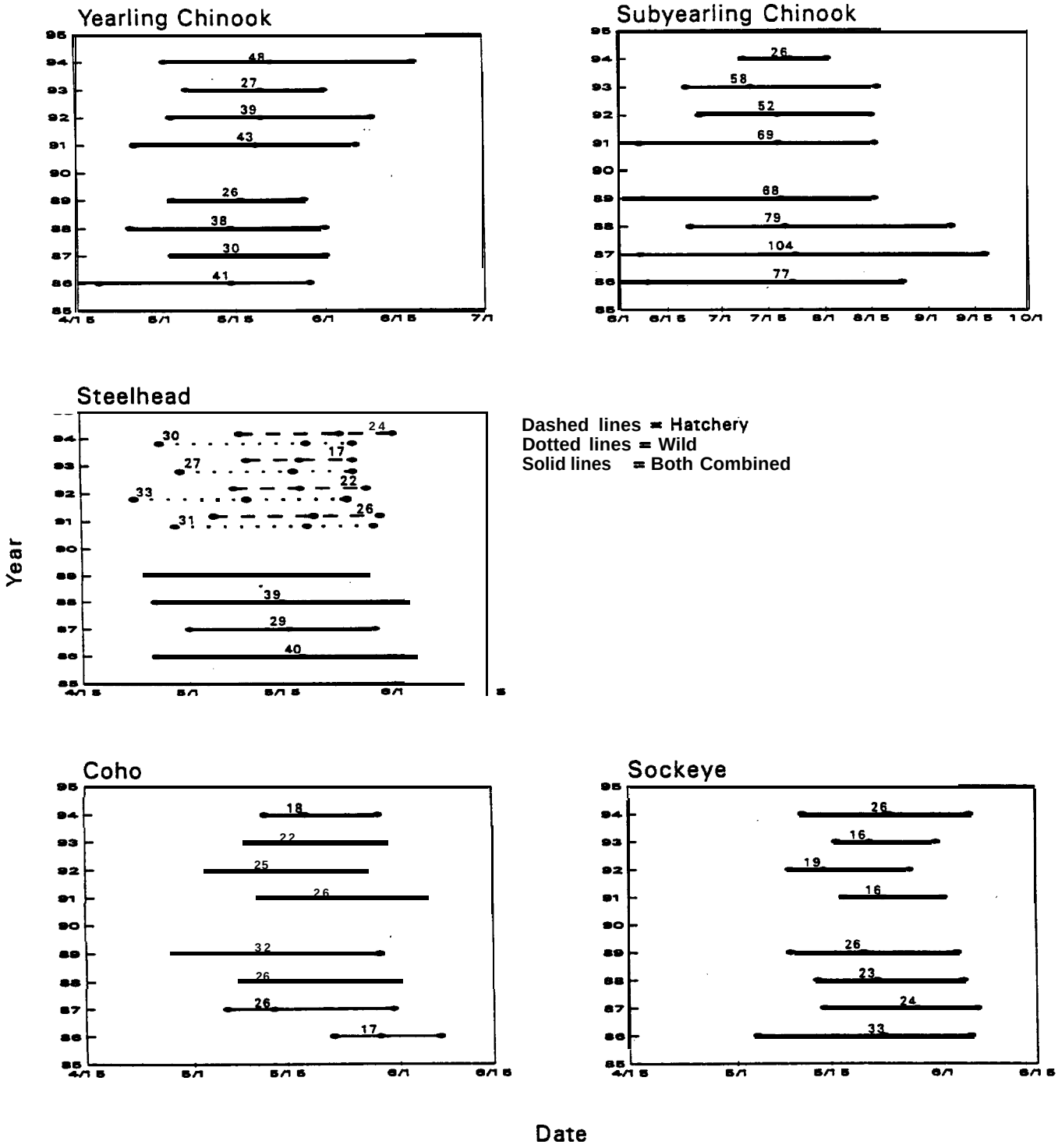

Figure 1. 10%, 50%, and 90% Passage Dates for each season at John Day Dam, by species, 1986-1994. The duration between 10-90% dates (in days) are indicated above each line. (No passage dates were calculated for 1990 due to biased sample season.)

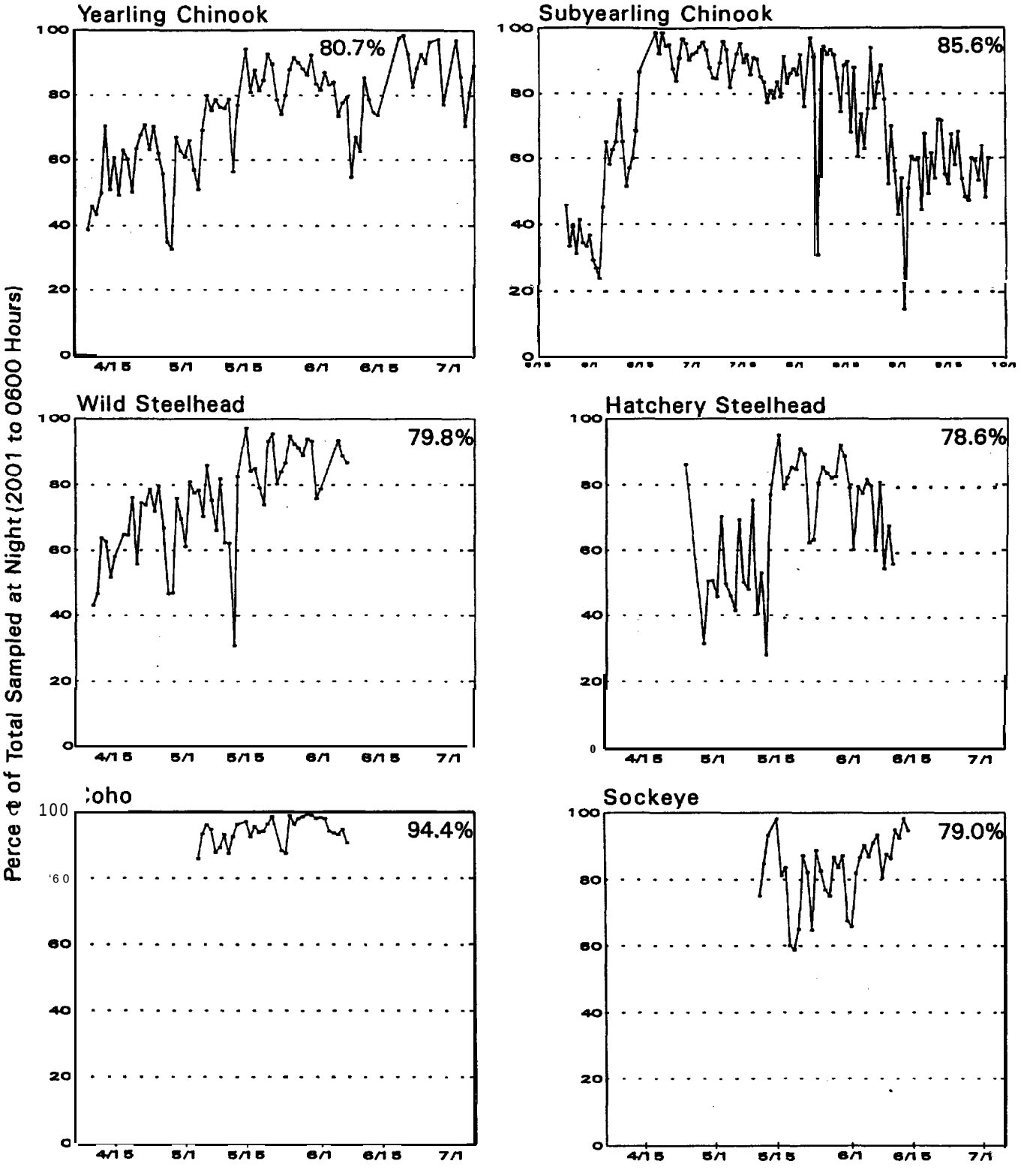

Figure 2. Percent of daily total sampled at night, 2001 - 0600 hours, (P.D.T.) at John Day Dam. Daily samples < 35 were excluded. The season Total Night Passage Percentage is indicated in the upper right corner.

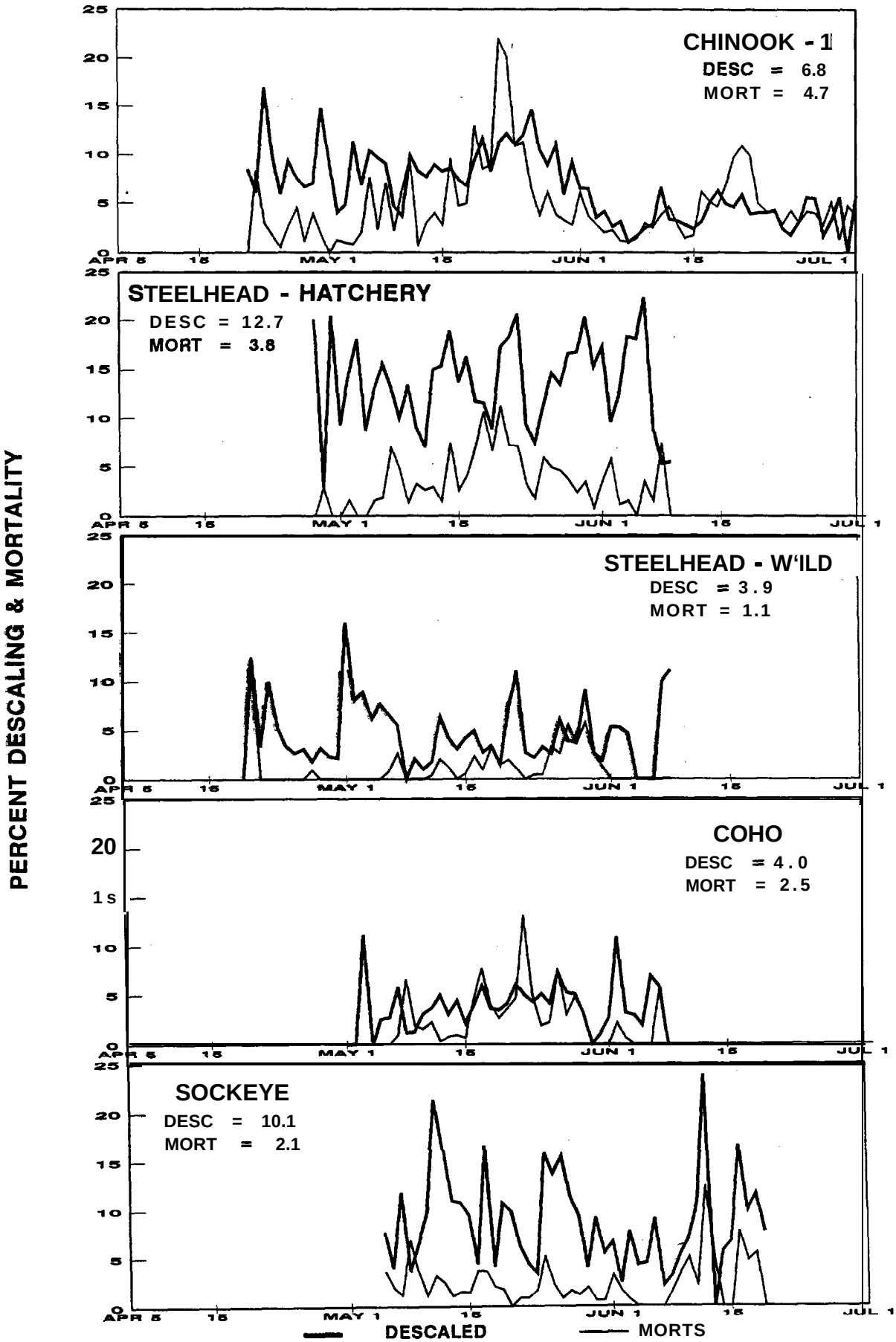

Figure 3. 'Daily descaling and mortality rates for spring migrants at John Day Dam, 1994. Samples<35 were excluded. (Seasonal descaling & mortality is indicated on each graph.)

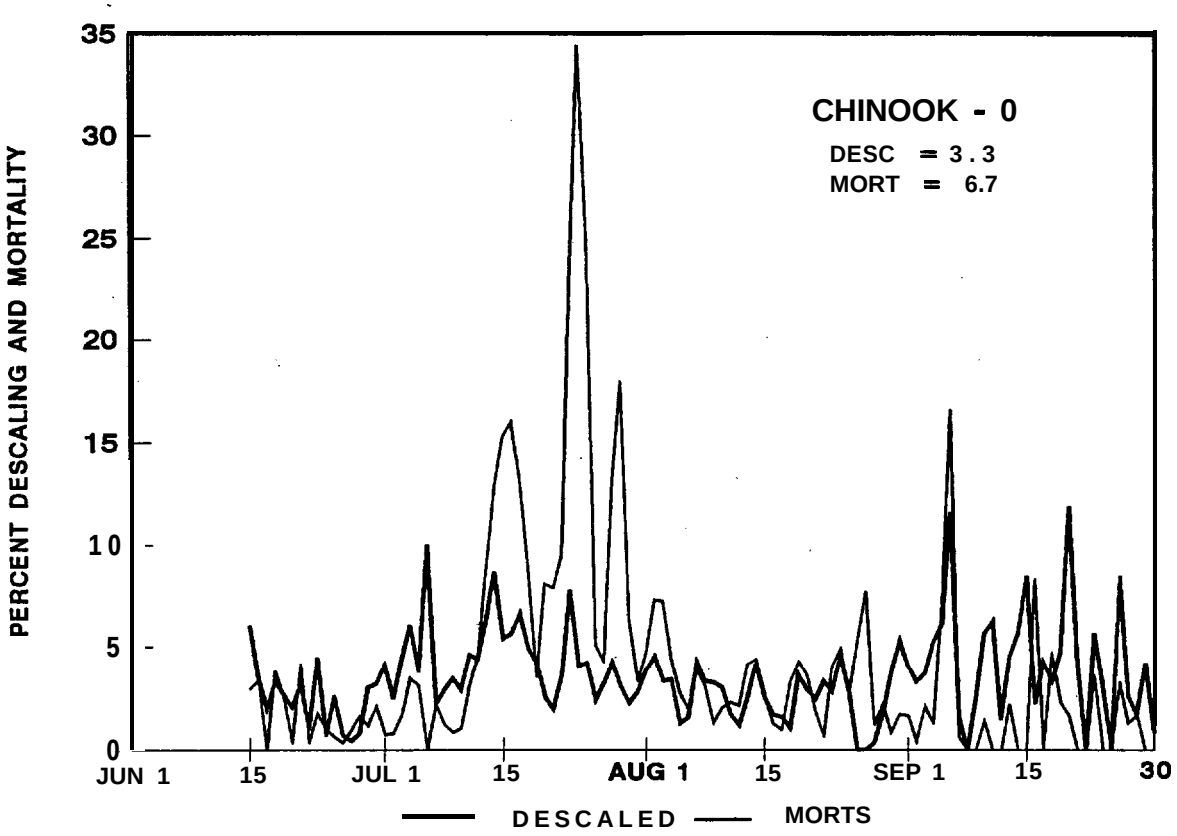

Figure 4. Daily descaling and mortality rates for subyearling chinook at John Day Dam, 1994. Samples<35 were excluded.

(Seasonal descaling & mortality is indicated)

Appendix A, Table 1. PIT Tag recovery detail at John Day Dam, 1994.

RELEASE SITE	n	SPECIES	RUN	REARING	TRAVEL TIME IN DAYS Min TT	Max TT	AVG TT	Total km Upstream of JDA	Average Speed (km/day)
Big Canyon Facility	1	Steelhead	Summr	Hatchery			45.1	596	13.2
Camas Creek	1	Chinook	spring	Wild			205.0	554	2.9
Clearwater River	2	Steelhead	Summer	Hatchery	22.5	36.4	30.5	399	13.1
Clearwater River, SF	2	Steelhead	Summer	Hatchery	27.5	32.4	30	519	17.3
Clearwater T m p	3	Chinook	Unknown	Hatchery	37.5	39.5	35.5	409	10.6
	2	Chinook	Unknown	Wild	28.4	32.4	29.4		13.9
	5	Steelhead	Summer	Hatchery	19.7	25.4	23		20.3
	4	Steelhead	Summer	Wild	17.4	42.8	31		13.2
Columbia River	3	Chinook	Fall	Wild	4t .9	53.2	46.5		unknown
Crooked Fork Cmk	1	Chinook	Spring	Wild			263.2	669	2.5
	t	Steelhead	Summr	Wild			208.8		3.2
Crooked Fork Cr. Tmp	2	Steelhead	Summer	Wild	28.4	2 7 . 7	27.1	672	24.6
Crooked River	1	Steelhead	Summer	Wild			26.5	613	22.9
Crooked River Trap	2	Chinook	Spring	Hatchery	31.3	41.4	36.4	614	15.0
	1	Chinook	spring	Wild			67.4		0.1
Curl Lake Rearing Pond	4	Steelhead	Summer	Hatchery	15.4	30.7	20.3	354	17.4
Dryden Acclimation Pond	4	Chinook	Summer	Hatchery			unknown	433	unknown
Dworshak Hatchery	29	Chinook	Spring	Hatchery	21.1	67.2	37.7	454	123
	15	Steelhead	Summer	Hatchery	17.9	47.5	22.3		20
Entiat Hatchery	1	Chlnook	Spring	Hatchery			37.5	445	11.0
Grand Ronde River	1	Chlnook	Spring	Hatchery			29.2	445	15.3
	1	chinook	Spring	Wild			41.7		10.7
	4	Steelhead	Summer	Hatchery	21 .a	32.4	28		15.9
	1	Steelhead	Summer	Wild			25.7		17.4
Hazard Cmk	1	Steelhead	Summer	Hatchery			40.4	649	16.1
Hells Canyon Dam	1	Chinook	Spring	Hatchery			42	572	13.5
Hells Canyon Dam	1	Steelhead	Summer	Hatchery	27.5	36.6	32.1		17.8
Imnaha River	1	Chinook	Summer	Wild			102.6	453	2 5
Imnaha River Weir	2	Chinook	Spring	Hatchery	50.5	55.0	526	557	10.6
Imnaha River Tmp	1	Steelhead	Summer	Hatchery			211.4	490	t7.3
	2	Steelhead	Summer	wild	21.2	23.5	22.4		21.9
Knox Bridge	7	Chlnook	Summer	Hatchery	39.1	71.2	529	505	15.2
Leavenworth Hatchery	3	Chinook	Spring	Hatchery			unknown	453	unknown
Little Goose Dam	29	Chinook	Spring	Hatchery	10.2	59.8	17.1	255	16.5
	a	Chinook	Unknown	Hatchery	11.4	24.4	13.6		21.2
	19	Steelhead	S - r	Hatchery	a.5	33	11.0		24.2
Lolo Creek	2	Chinook	Spring	Wild	50.6	124.5	57.7	486	5.5
Lookingglass Hatchery	2	Chinook	Spring	Hatchery	34.3	40.4	37.4	555	15.7
Looking Glass Creek	1	Chinook	n	Wild			260.6	563	2 4
Lower Granite Dam	27	Chinook	n	Hatchery	15.5	44.7	21 .a	345	16.1
	3	Chinook	Unknown	Hatchery	12.3	27.7	20.7		16.5
	31	Steelhead	Summer	Hatchery	11.3	30.7	97.1		20.4
	1	Steelhead	Summer	Wild			12.0		25
Lower Monumental Dam	65	Chinook	Spring	Hatchery	6.2	41	lo.7	242	22.6
	22	Steelhead	Summer	Hatchery	5.4	la.2	9.5		2 5 2
Marsh Creek Trap	1	Chinook	Spring	Wild			223.3	967	4.3
McNary Dam	9	Steelhead	Summer	Hatchery			unknown	123	unknown
Methow Rearing Pond	2	Chinook	Summer	Hatchery	33.5	54.7	44.3	555	12.5
Pahsimeroi Weir	2	Steelhead	Summer	Hatchery	35.3	35.7	35.5	969	27.3
Papoose Creek	1	Chinook	Spring	Hatchery			50.2	551	13.2
Powell Rearing Pond	1	Chinook	Spring	Hatchery			67	669	7.7
Priest Rapid Hatchery	3	Chinook	Fall	Hatchery	23.1	31.2	27.4	292	10.7
Rapid River Hatchery	2	Chinook	Spring	Hatchery	43.7	43.5	43.6	531	14.4
Red River	1	chinook.	Spring	Wild			210.6	620	2 5
	1	Steelhead	Summer	Wild			211.6		2.9
Rock Island Dam	4	chinook	Unknown	Hatchery	15.6	35.6	23.6	383	16.2
	14	Chinook	Unknown	Unknown	13.1	99.9	25.5		13.3
	12	Steelhead	Summer	Hatchery	125	31.6	10.5		19.6
	a	Steelhead	Summer	Wild	11.6	25.5	16.2		23.6
	5	Sockeye	Unknown	Wild	9.5	36.5	19.3		10.5
Salmon River, E FK	1	Chinook	Spring	Wild			W 2 4	1030	3.8
Salmon River, E FK W	2	Steelhead	Summer	Hatchery	32	46.5	40.3	1050	23.3
Salmon River, S FK	1	Chinook	Summer	Wild			269.7	693	2 6
Salmon River Trap	2	chinook	Unknown	Hatchery	25.5	a . 5	27.6	553	20.4
	1	Chinook	Unknown	Wild			W.6		20.4
	3	Steelhead	Summer	Hatchery	15.6	27.1	23.2		24.3
	1	Steelhead	Summer	Wild			15.3		35.6
Sawtooth Hatchery	3	Chinook	Spring	Hatchery	33.2	43.1	35.6	1095	29.8
Sawtooth Hatchery	1	Steelhead	Summer	Hatchery			47.5		23.1
Snake River	22	Chinook	Spring	Hatchery	a	39.4	126	175	13.7
	9	Chinook	Spring	Hatchery	14.6	39.1	25.5		6.1
	1	Chinook	Spring	Wild			29.4		a
	45	Steelhead	Summer	Hatchery	123	31.5	20.5		a.5
	a	Steelhead	Summer	Hatchery			unknown		unknown
	1	chinook	Fall	Wild			56.7		3
Snake Trap	1	Chinook	Unknown	Hatchery			41.7	400	9.6
	1	Chinook	Unknown	Wild			22.1		16.1
	a	Steelhead	Summer	Hatchery	20.7	32.5	26.9		14.9
	7	Steelhead	Summer	Wild	16.5	25.5	20.3		19.7
Wallowa Hatchery	2	Steelhead	Summer	Hatchery	35.6	35.1	35.9	541	17.9
Wells Hatchery, WDF	3	Chinook	Summer	Hatchery			unknown	453	unknown
Winthrop Nat. Fish Hatcher	1	Chinook	Spring	Hatchery			27.7	577	20.8
Yakima Rim	1	Chlnook	Spring	Hatchery			23.2	192	8.3
TOTAL NUMBER	516								

Table 2 Summary of Smolt Condition Subsampling for the 1994 Sampling Season at John Day Dam Expressed as Percents.

Species	Sample Size	Part Descale (3-20%)	Condition						
			Injury	Gill	Fungus	Bird	Para	Colu	GBD
Chin-l	3879	14.5	6.2	0.2	0.9	1.5	0.0	0.7	0.0
Chin-O	4579	8.1	3.8	0.1	1.5	0.2	0.3	8.7	0.0
Sthd-W	1605	8.7	2.9	0.2	1.4	2.6	2.2	0.0	0.0
Sthd-H	1812	24.2	9.9	1.9	3.9	15.1	0.1	0.1	0.0
Coho	1450	9.7	2.7	0.1	0.3	2.7	0.1	0.1	0.0
Sockeye	1656	16.0	2.1	0.5	0.2	0.5	0.0	0.1	0.0
TOTALS	14,981	12.8	4.8	0.4	1.4	2.8	0.4	2.9	0.0

Partial Descaling: > 3% and < 20 % maximum on either side.

Injury: . . . . . head, eye, or body injury.

Operculum: . . . . folded or torn gill cover.

Fungus: . . . . . external fungal infection.

Bird Marks: . . . . injuries inflicted by a bird.

Parasites: . . . . external parisites.

Columnaris: . . . . lesions or ulcers.

External Gas Bubble Symptoms: presence of gas bubbles in the fins or head. All four levels of BGS are combined in this table.

Table 3 Interruptions in the Sampling Season (179 Days or 4,296 Hours) Due to Unit 3 Shutdowns (Hours Out of Service) and Airlift Lost or Biased Samples (Hours Out of Service).

End Date	Batch #	Unit 3 00s	Airlift 00s	Reason for Interruption
4/30/94	94026		5.5	Fallen Airlift Tower
5/04/94	94030	8.5		Funnel & Screen
5/08/94	94034		2.0	Suspected Funnel Plug
5/12/94	94038	1.5		Video/Diver
7/01/94	94088	3.0		Video
7/06-07/94	94093-094	25.0		Funnel & Screen
7/27/94	94115		1.0	Sample Partially Lost
7/28/94	94116	2.0		Video
8/29/94	94148		2.0	Valve was left open
9/01/94	94151	1.5		Video
9/07-08/94	94157-158	27.5		Funnel & Screen
Total **Hours**		**69.0**	**10.5**	

Total Hours Out of Service = 79.5

Sampling Season End Dates (4/6 - 10/29)

Percent of Season Out of Service: 79.5 / 4,296 = 1.85%

APPENDIX B
BONNEVILLE DAM - 1994

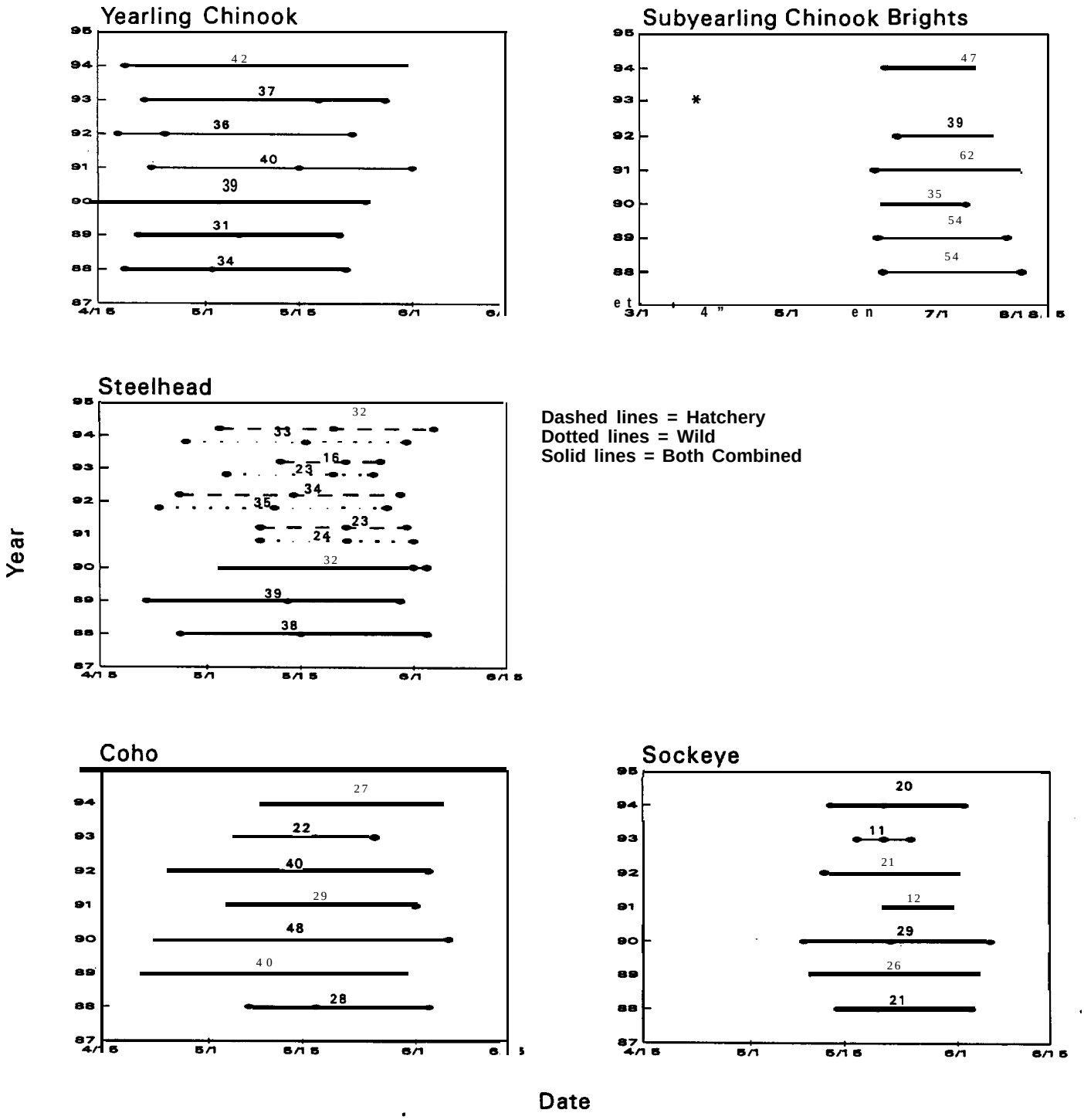

Figure 1. 10%, 50%, and 90% Passage Dates for each season at Bonneville Dam, by species, 1988-1994. The duration between 10-90% dates (in days) is indicated above each line. * No dates due to screens being pulled.

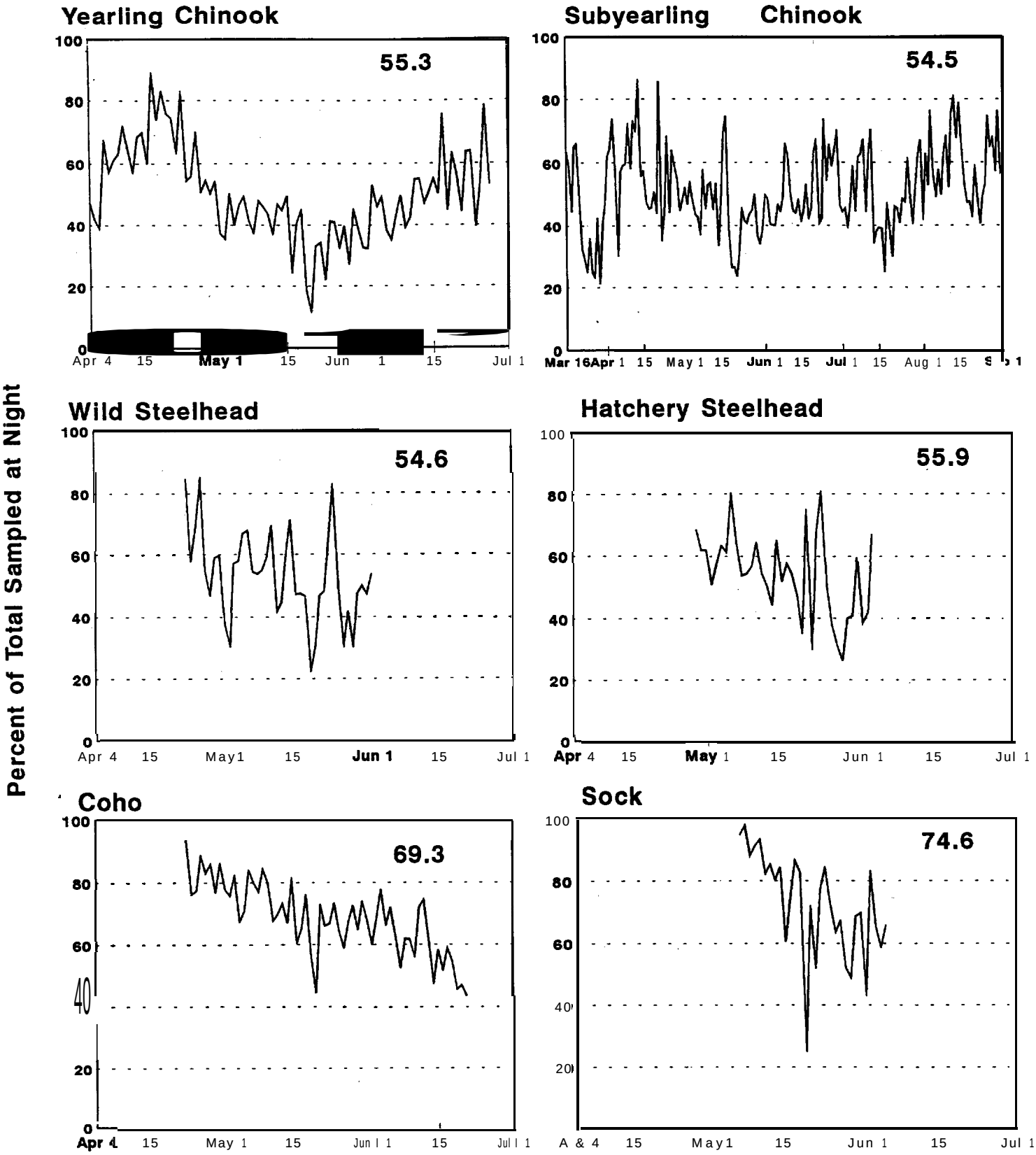

Figure 2. Percentage of daily collection sampled at night, 2001 to 0600 hours, (PDT) at Bonneville Dam. Daily samples<35 were excluded. The season total night passage percentage is indicated in the upper right corner.

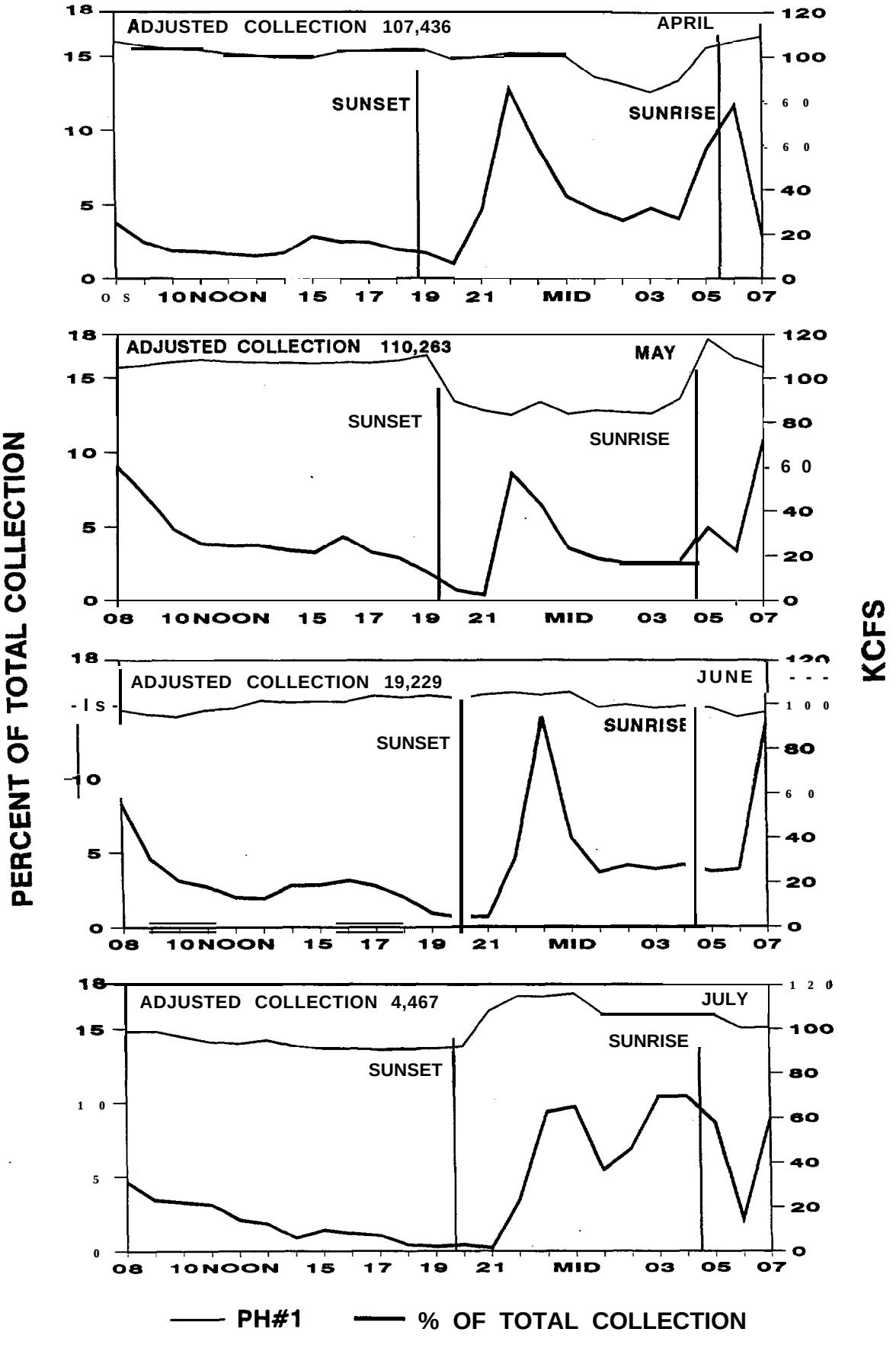

Figure 3. Monthly diel passage patterns for yearling chinook at Bonneville Dam, PH#1, 1994.

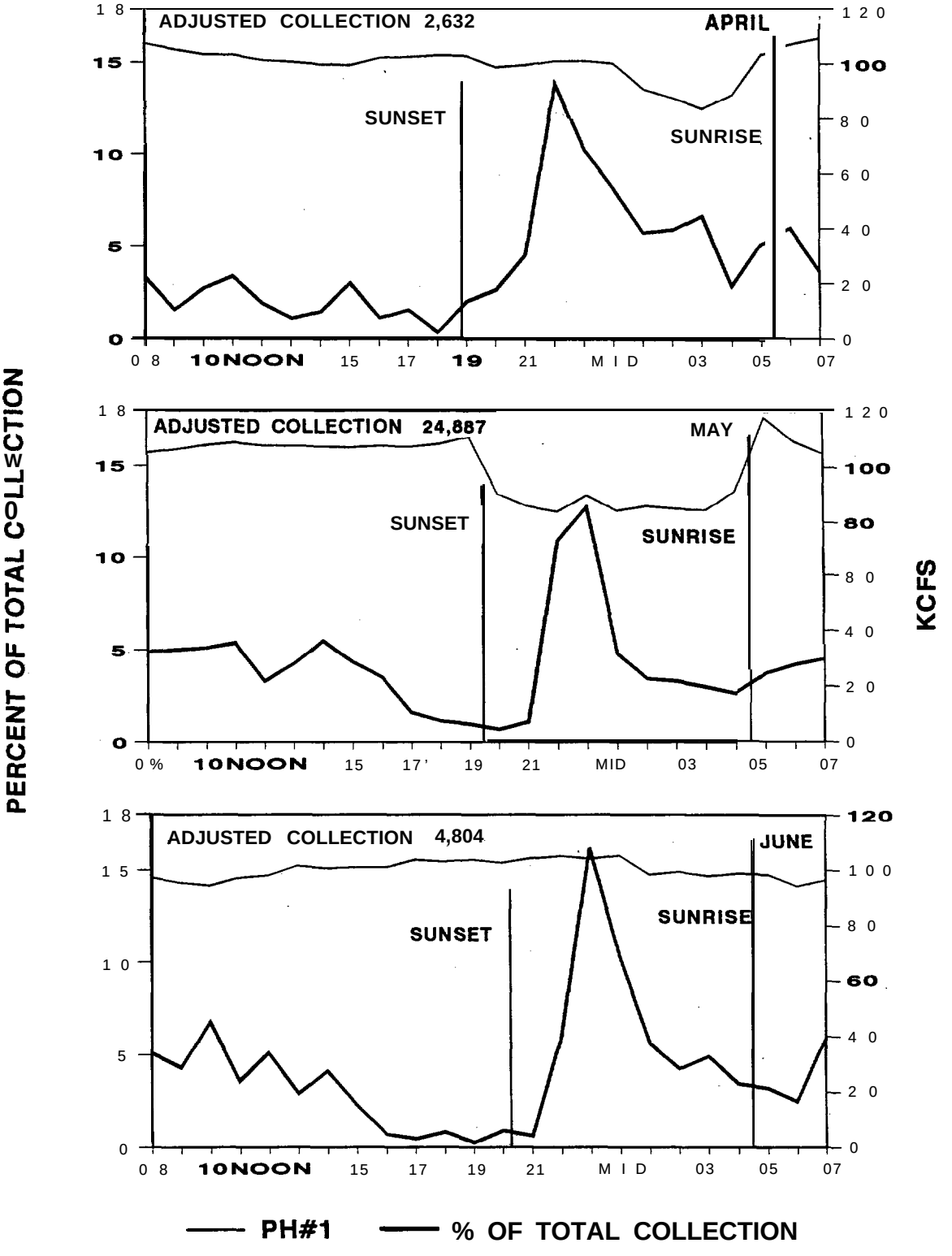

Figure 4. Monthly diel passage patterns for hatchery steelhead at Bonneville Dam, PH#1, 1994.

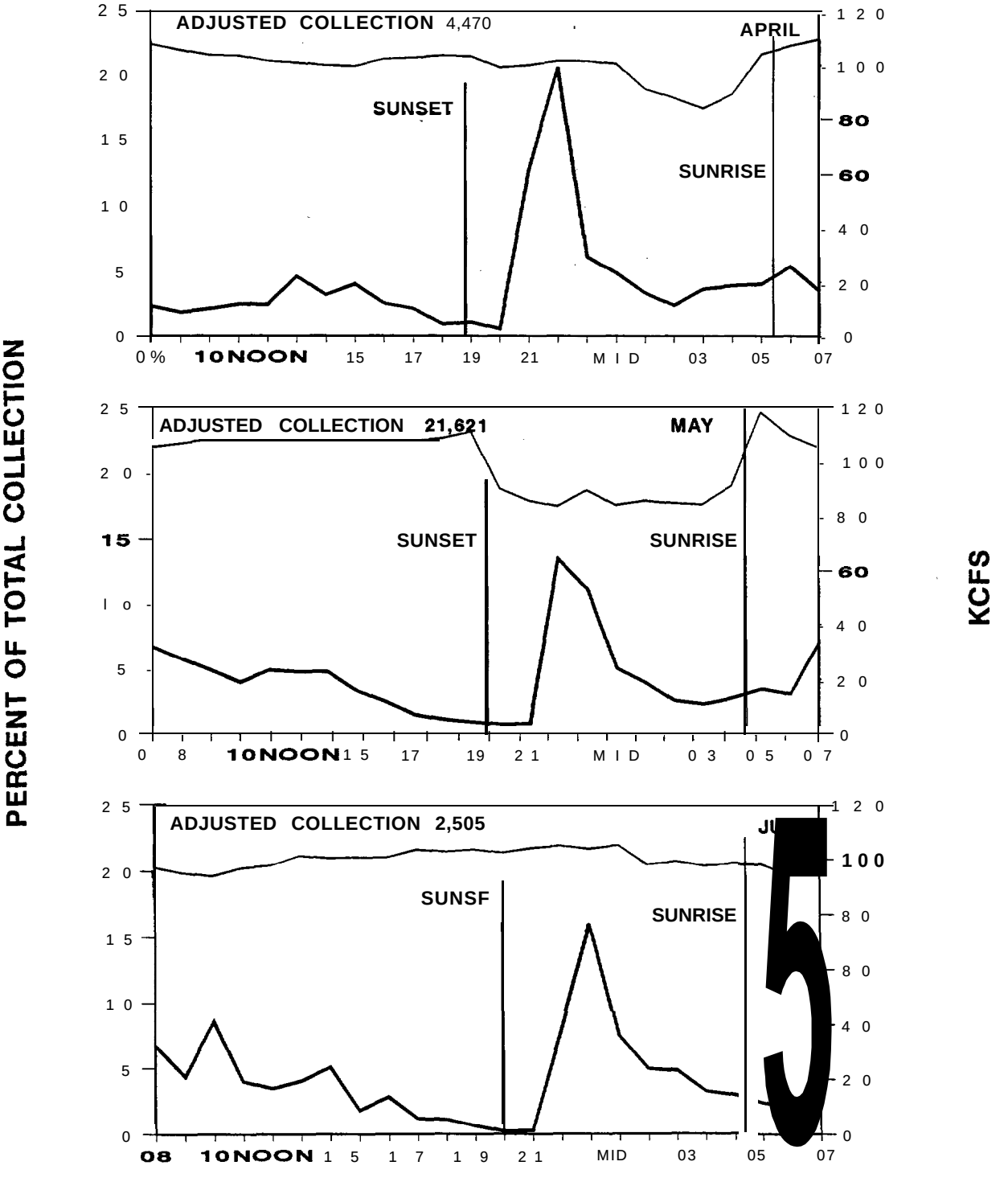

Figure 5. Monthly diel passage patterns for wild steelhead at Bonneville Dam, PH#1, 1994.

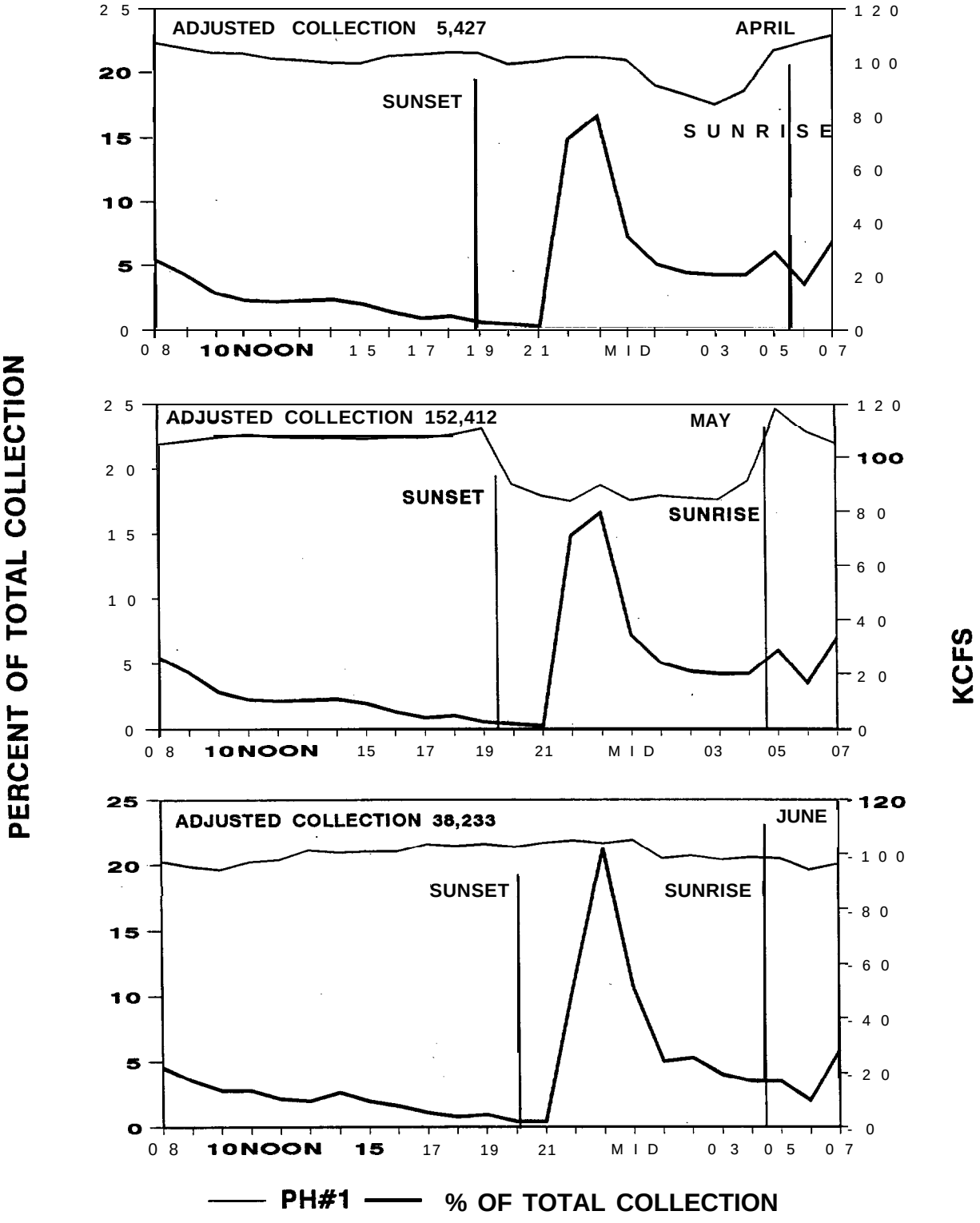

Figure 6. Monthly diel passage patterns for coho at Bonneville Dam, PH#1, 1994.

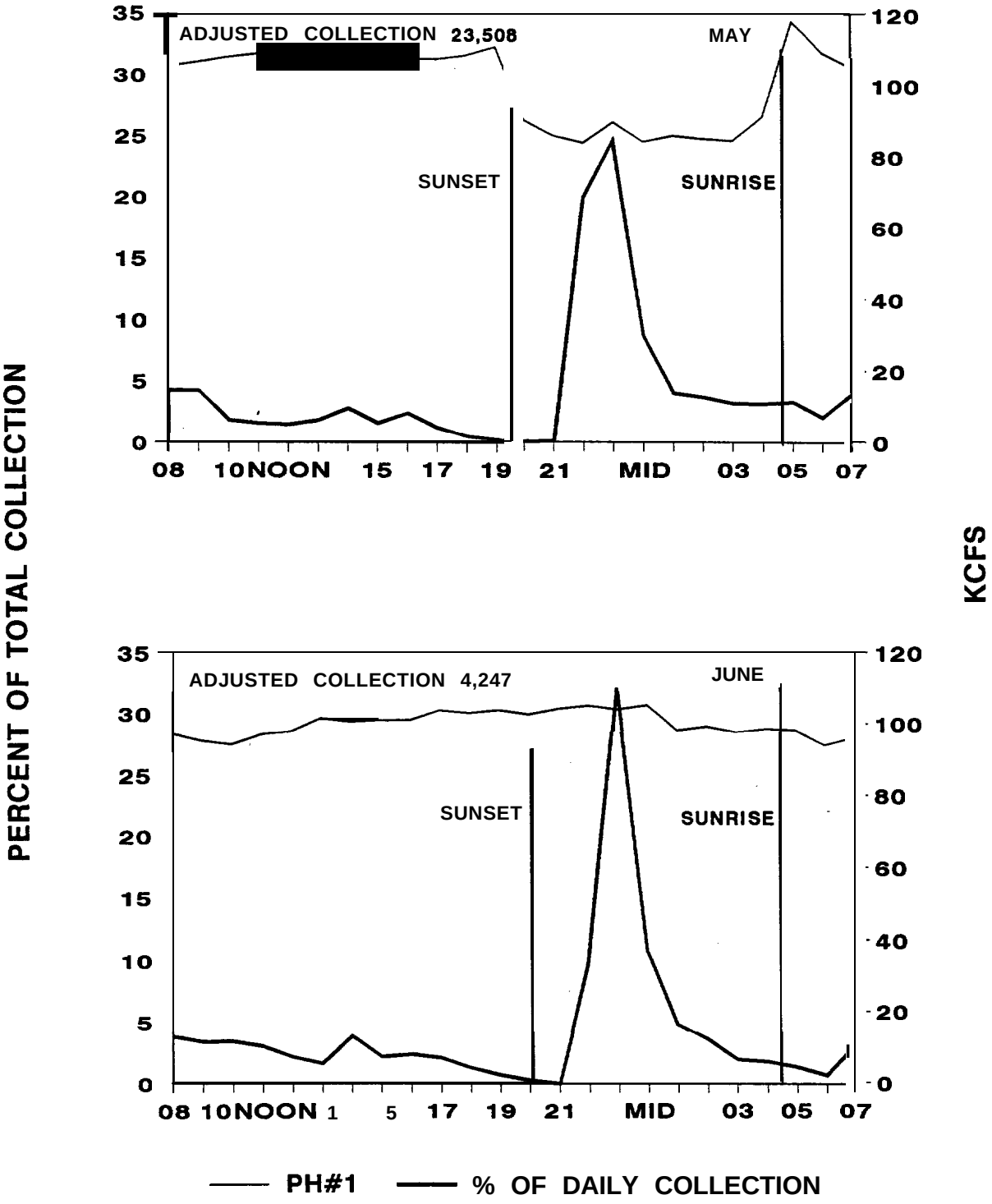

Figure 7. Monthly diel passage patterns for sockeye at Bonneville Dam, PH#1, 1994.

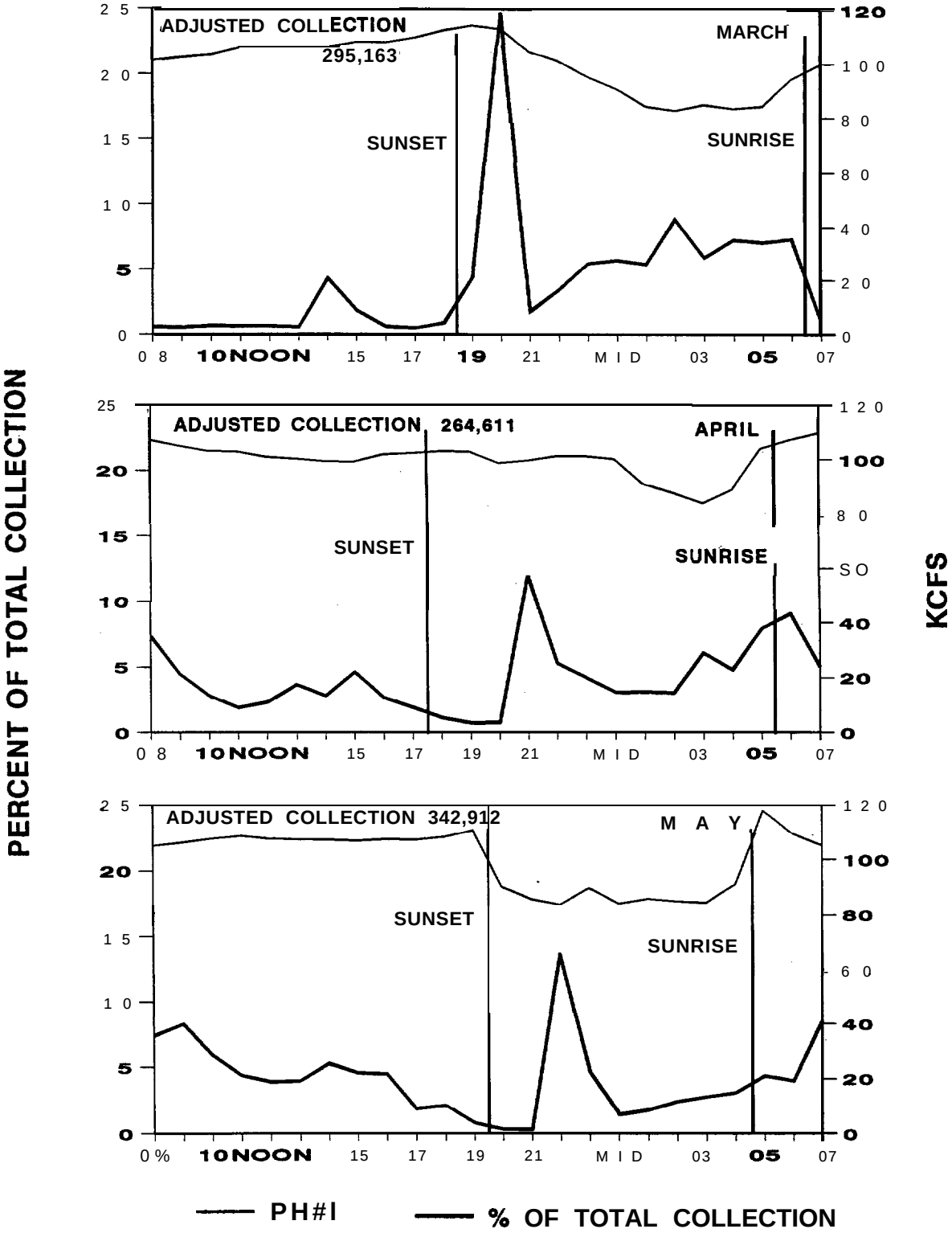

Figure 6. Monthly diel passage patterns for "tule" subyearling chinook at Bonneville Dam, PH#l, 1994.

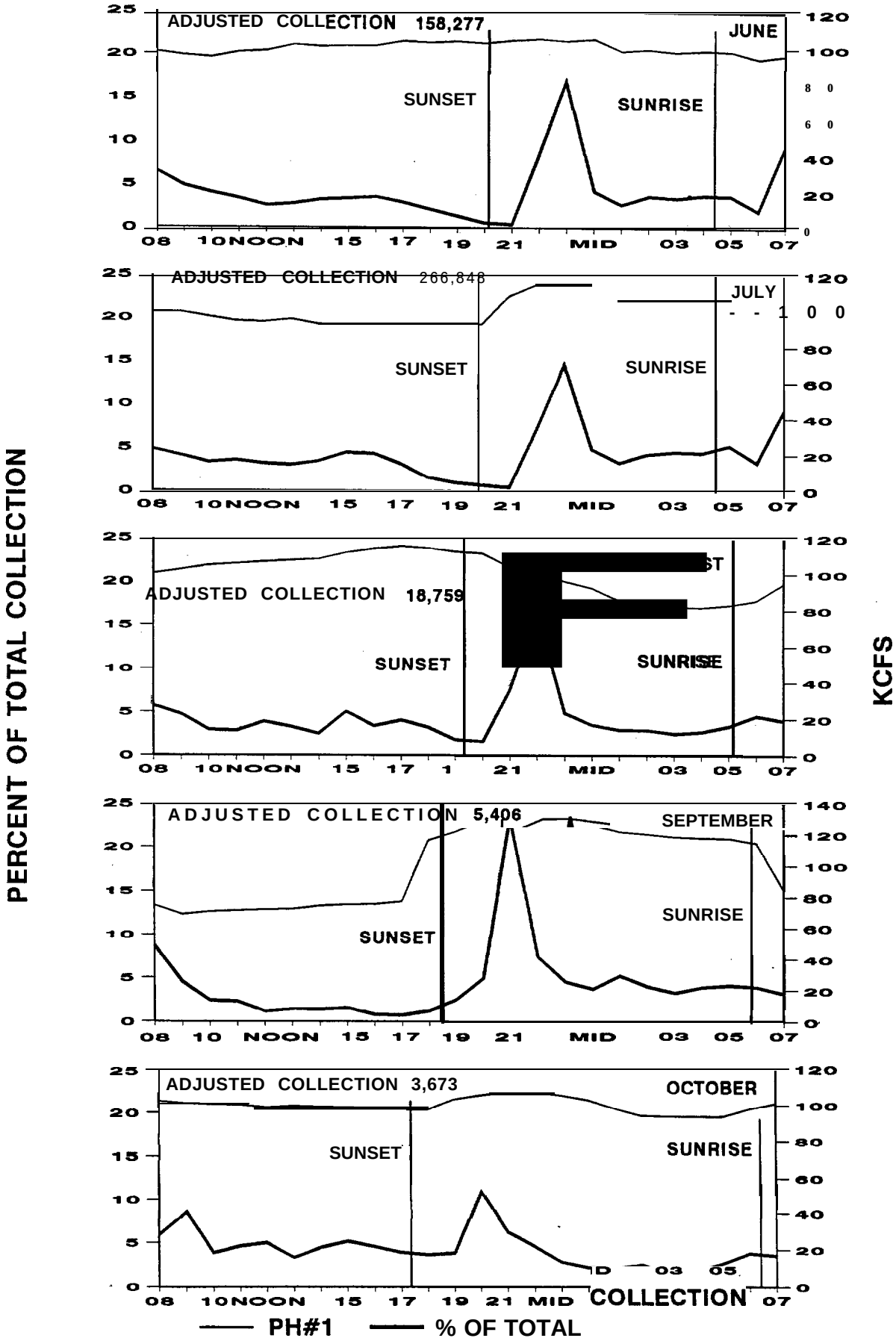

Figure 9. Monthly diel passage patterns for "upriver bright" subyearling chinook at Boneville Dam, PH#1, 1994.

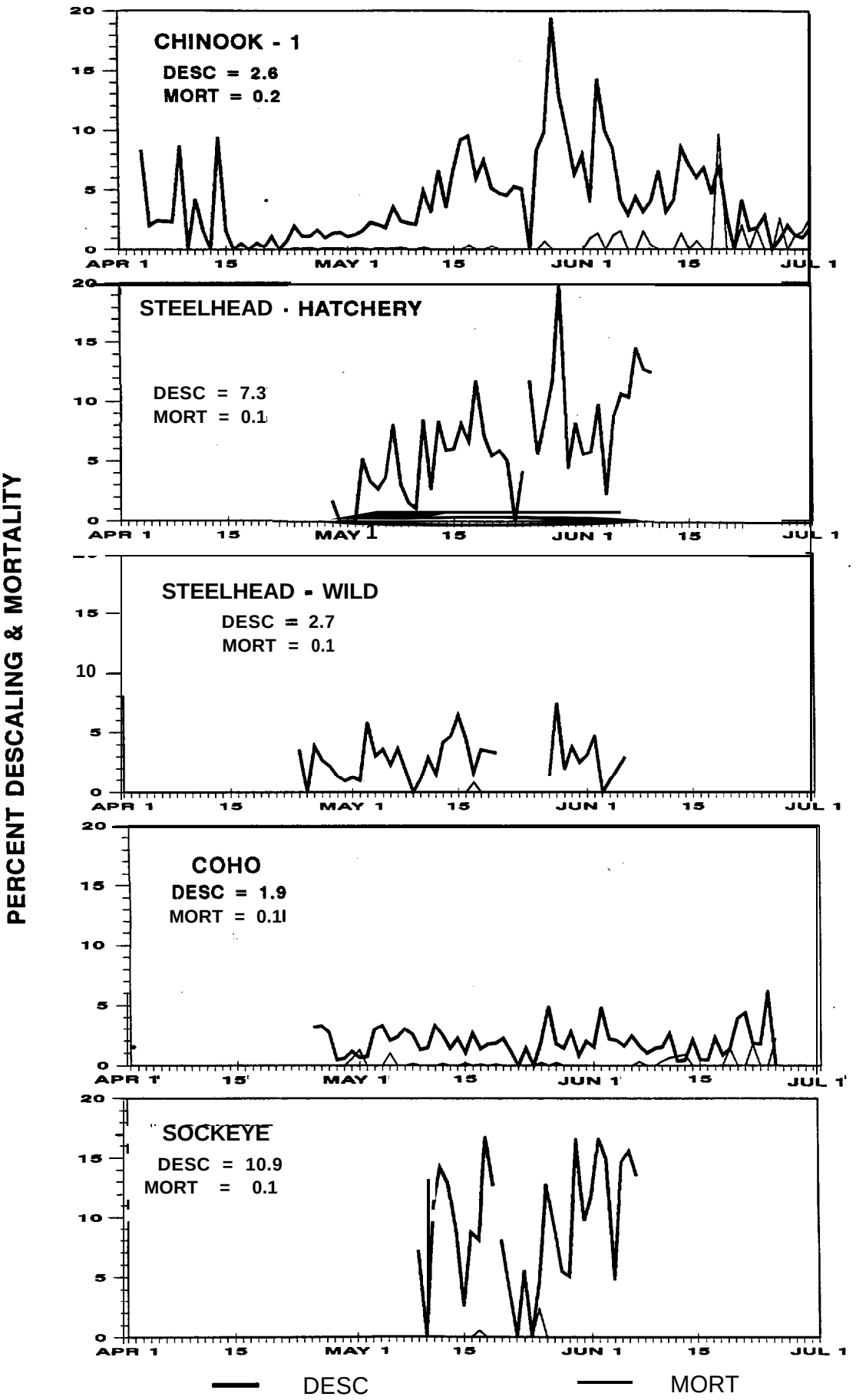

Figure 10. Daily descaling and mortality rates for spring migrants at Bonneville Dam, PH#1, 1994. Samples <35 were excluded. (Seasonal descaling & mortality is indicated)

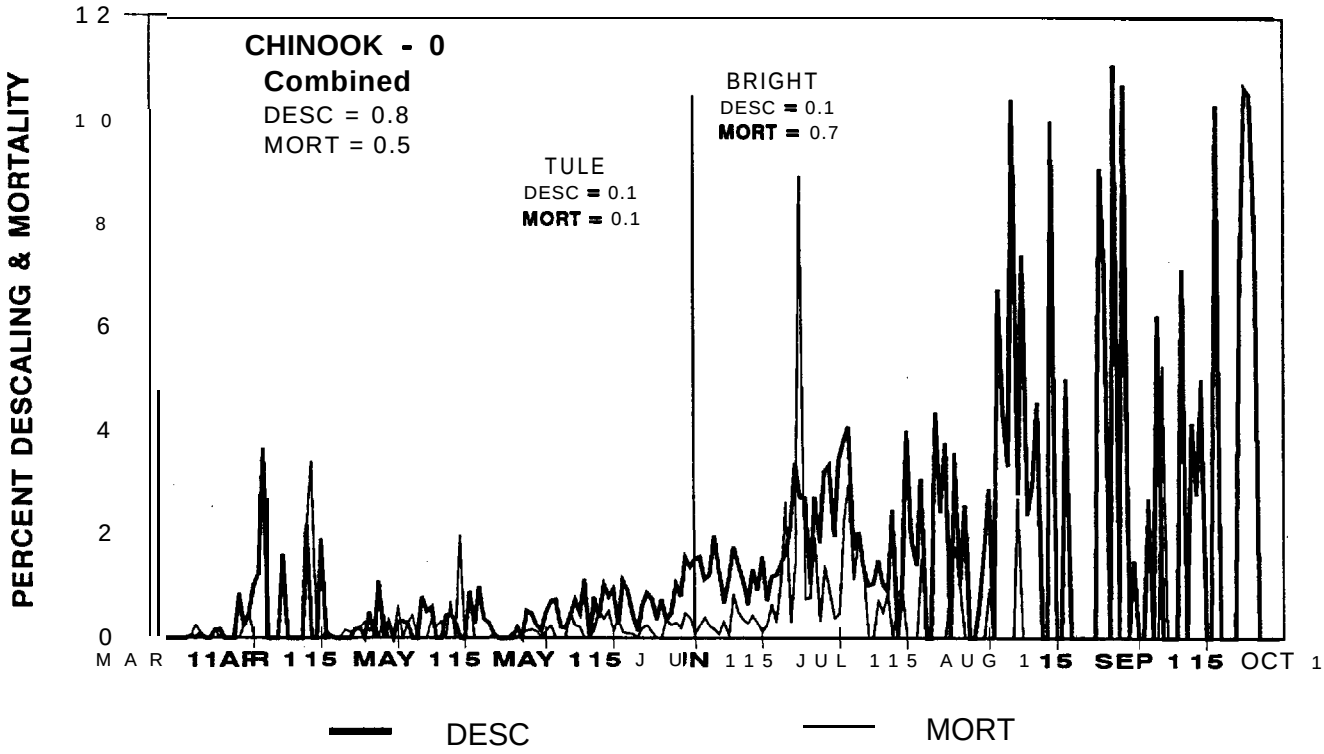

Figure 11. Daily descaling and mortality rates for subyearling chinook at Bonneville Dam, PH#1, 1994. Samples <35 were excluded.

(Seasonal descaling & mortality is indicated)

Appendix B, Table 12. PIT Tag recovery detail from PH1 at Bonneville Dam, 1994.

RELEASE SITE	n	SPECIES	RUN	REARING	TRAVEL TIME IN DAYS Min TT	Max TT	AVG TT	Total km Upstream of BON	Average Speed (km/day)
Bear Valley Creak	1	Chinook	Spring	Wild			289.3	1080	3.7
Big Creek	1	Chinook	Spring	Wild			298.3	039	3.2
Clearwater Trap	1	Chinook	Unknown	Hatchery			41.0	522	12.5
Columbia River	3	Chinook	Fall	Wild	44	48.4	46.2	unknown	unknown
Crooked Fork Creek	1	Chinook	Spring	Wild			283.2	782	3
Crooked River Trap	1	Chinook	Spring	Wild			46.7	727	15.6
Dryden Acclimation Pond	2	Chinook	Summer	Hatchery			unknown	548	unknown
Dworshak Hatchery	6	Chinook	Spring	Hatchery	24.8	80.2	43.7	577	13.2
	1	Steelhead	Summer	Hatchery			47.5		12.1
Imnaha River	1	Chinook	Summer	Wild			192.6	596	3.1
Imnaha River Trap	2	Steelhead	Summer	Wild	21	34.6	27.8	603	21.7
Knox Bridge	1	Chinook	Summer	Hatchery			44.3	91s	20.7
Leavenworth Hatchery	2	Chinook	Spring	Hatchery			unknown	566	unknown
Lemhi River	1	Steelhead	Summer	Hatchery			42.8	1007	23.6
Little Goose Dam	11	Chinook	Spring	Hatchery	12	22.4	18.7	401	24
	3	Chinook	Unknown	Hatchery	14.1	24.4	10.3		20.8
	3	Steelhead	Summer	Hatchery	12.4	20.3	17.4		23
Lolo Creek	1	Chinook	Spring	Wild			200.8	599	3
Lockingglass Hatchery	1	Chinook	Spring	Hatchery			38.6	699	18.1
Lower Granite Dam	4	Chinook	Spring	Hatchery	IS.2	37.3	26.1	461	17.7
	1	Chinook	Unknown	Hatchery			24.4		10.9
	2	Steelhead	Summer	Hatchery	19.6	39.7	29.7		15.5
	1	Steelhead	Summer	Wild			21.8		21.1
Lower Monumental Dam	15	Chinook	Spring	Hatchery	0.4	14.8	11.4	355	31.1
	1	Steelhead	Summer	Hatch&y			12.7		28
McNary Dam	2	Steelhead	Summer	Hatchery			unknown	236	unknown
Rock Island Dam	4	Chinook	Unknown	Unknown	15.6	99.9	49.6	490	10
	1	Steelhead	Summer	Wild			14.3		34.7
	1	Sockeye	Unknown	Hatchery			15.4		32.2
	4	Sockeye	Unknown	Wild	12	26.6	19.8		25.1
Salmon River, S FK	1	Chinook	Summer	Wild			2S9.7	806	3
Salmon River Trap	2	Chinook	Unknown	Hatchery	30.0	32.8	31.9	676	21.2
	2	Chinook	Unknown	Wild	34.8	38.0	36.9		18.3
Snake River	4	Chinook	Spring	Hatchery	9.2	14.7	10.8	288	26.7
	4	Chinook	Spring	Hatchery	25.1	30.6	28.1		10.2
	3	Steelhead	Summer	Hatchery	21.5	44.5	35.8		8
	3	Steelhead	Summer	Hatchery			unknown		unknown
Wells Hatchery, WDF	1	Chinook	Summer	Hatchery			32.6	596	18.3
White Sand Creek	1	Chinook	Spring	Hatchery			303.5	782	2.6
Yakima River	1	Chinook	Spring	Hatchery			29.2	305	10.4
TOTAL NUMBER	101								

Table 2. Summary of smolt condition subsampling from PH-1 at Bonneville Dam, 1994. Expressed as percent of total.

Species	Sample Size	Partial Desc (3-20)	Condition						
			Injury	Gill	Fungus	Bird	Para	Colu	GBS
Chin-1	4,018	10	2	<.5	1	1	<.5	0	0
Chin-0	7,149	4	1	<.5	<.5	<.5	<.5	0	0
Sthd-W	1,429	9	3	1	1	3	8	0	1
Sthd-H	1,595	22	4	3	1	8	1	<.5	<.5
Coho	2,725	7	1	<.5	1	<.5	<.5	0	0
Sock-W	1,047	27	1	2	<.5	<.5	0	0	0
Sock-H	49	14	4	0	0	0	0	0	0
Totals	18,012	9	2	1	1	1	1	<.5	<.5

Table 3. PH-1 sampling interruptions at Bonneville Dam, 1994.

End Date	Reason for Outage	Hours Missed
March 19	Trash sweep repairs	3
March 20	Excessive fish passage	2
April 3	Daylight savings	1
April- 12	Trap cable replacement	0.5
April 13	Trap cable replacement	7
April 17	Excessive fish passage	2
May 24	Trap repair	1
June 3	Trap repair	1
June 13	Trap cable replacement .	3.5
June 21	Trap cable replacement	3
June 30	Trap cable replacement	3
July 12	Trap repair	1
July 22	Trap cable- replacement	2
July 30	Trap cable replacement	3
August 4	Trap repairs	1
August 14	Trash sweep repairs	2
Sept. 4	Trap cable replacement	6
Sept. 21	Trap cable replacement	6
Oct. 9	Trash sweep repairs	5
Oct. 28	Sample flume malfunction	2
	Total-hours missed	55

APPENDIX C
INCIDENTAL CATCH - 1994

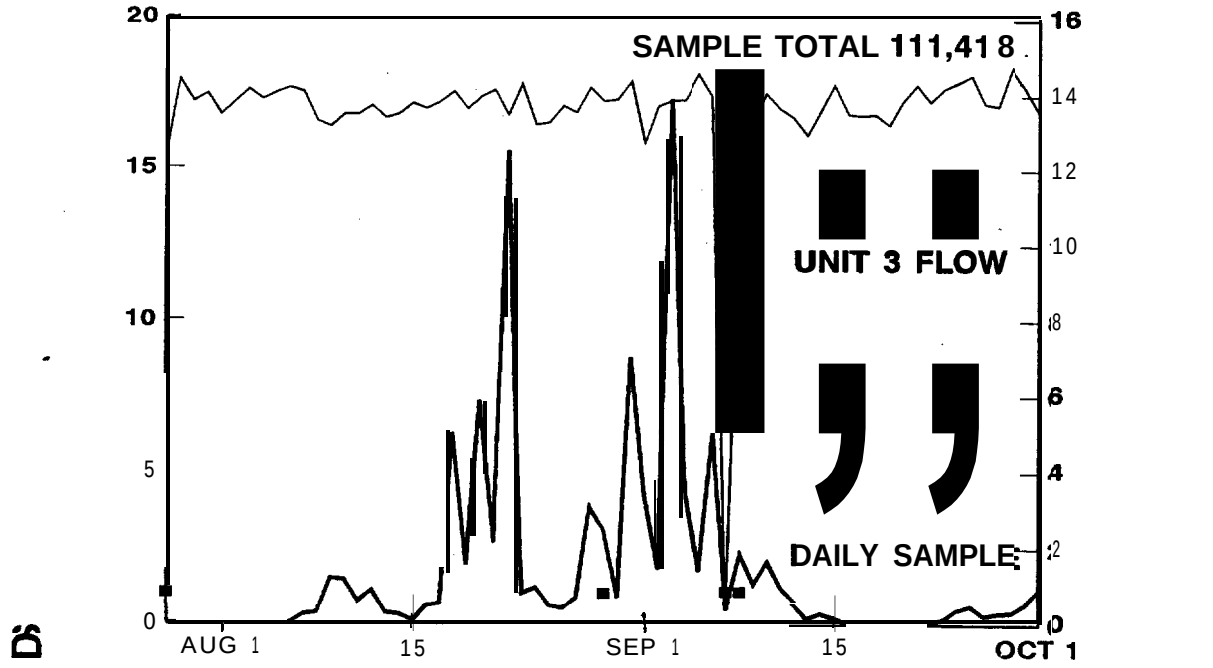

Figure 1. Seasonal juvenile shad count at John Day Dam, 1994.

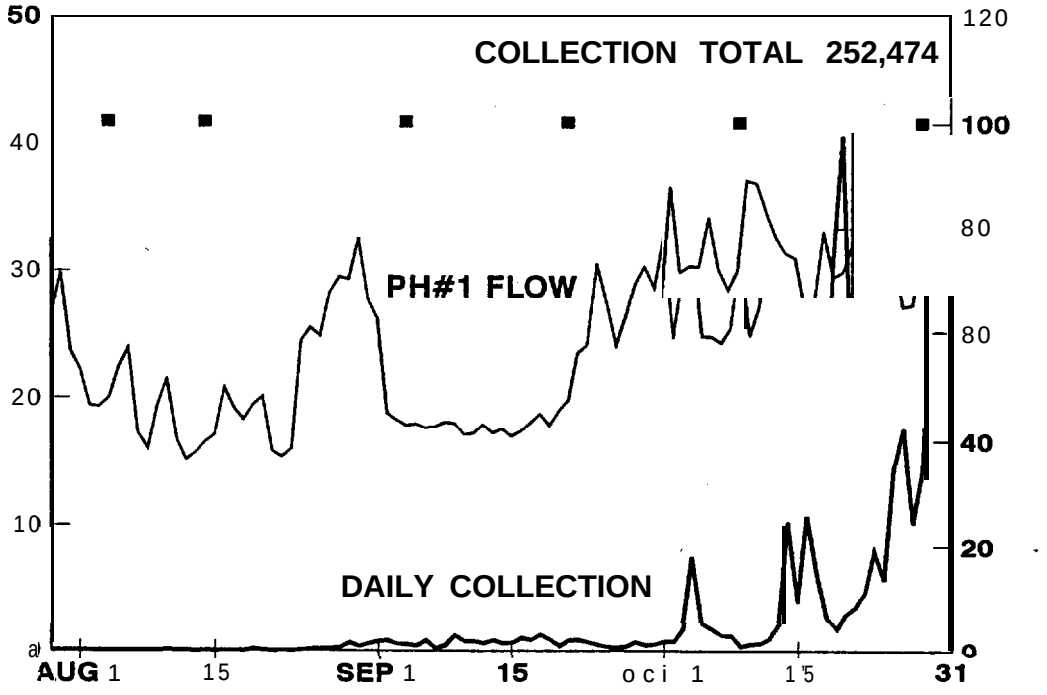

Figure 2. Seasonal juvenile shad count at Bonneville Dam, 1994.

■ Indicates sample days less than 24 hours.

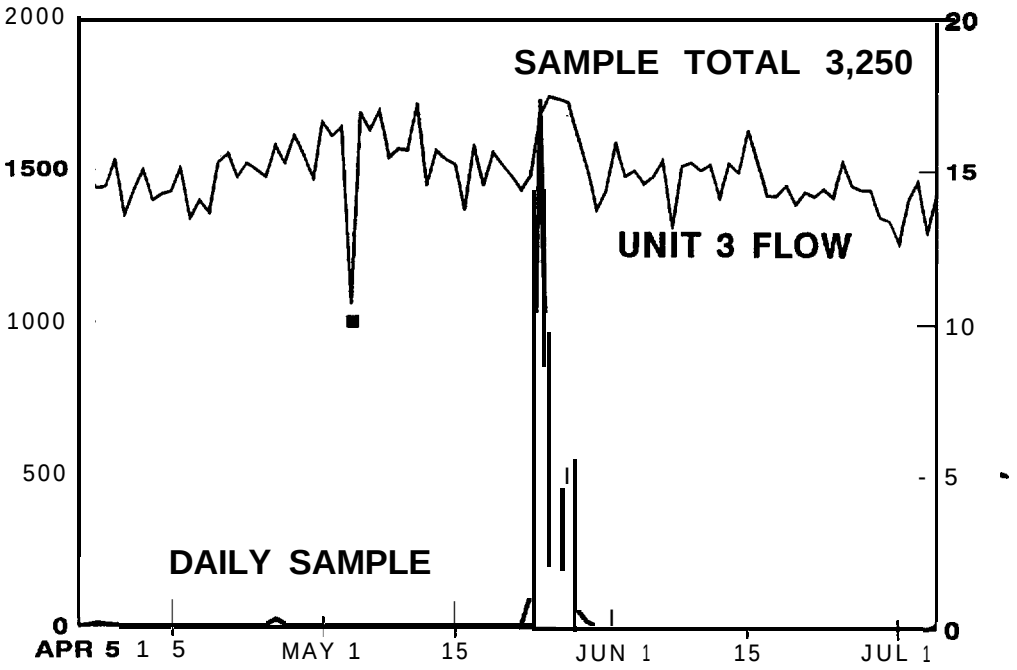

Figure 3. Seasonal juvenile lamprey count at John Day Dam, 1994.

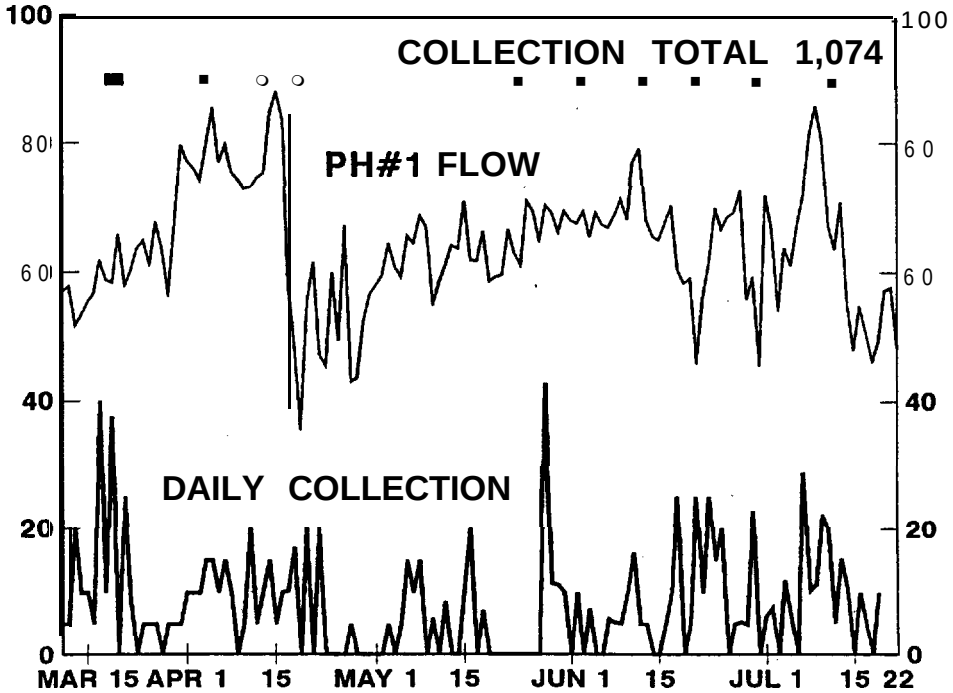

Figure 4. Seasonal juvenile lamprey count at Bonneville Dam, 1994.

▪ **Indicates sample days less than 24 hours.**

Table 1 Incidental Species Captured at John Day Dam, 1994.

Species	Number Sampled
Shad	
Juvenile	111,418
Adult	460
Lamprey	
Juvenile	3,250
Adult	28
Sculpin	479
Mountain Whitefish	353
Sucker	234
Walleye	167
Peamouth	104

Table 2 Incidental Species Captured at Bonneville Dam, 1994

Species	Sampled	Number Collected
Shad		
Juvenile	193,644	292,601
Adult	24	75
Stickleback	1,971	6,636
Lamprey		
Juvenile	523	6,228
Squawfish	106	257
Sculpins	62	294
Smallmouth Bass	58	263

APPENDIX D
HISTORIC DATA

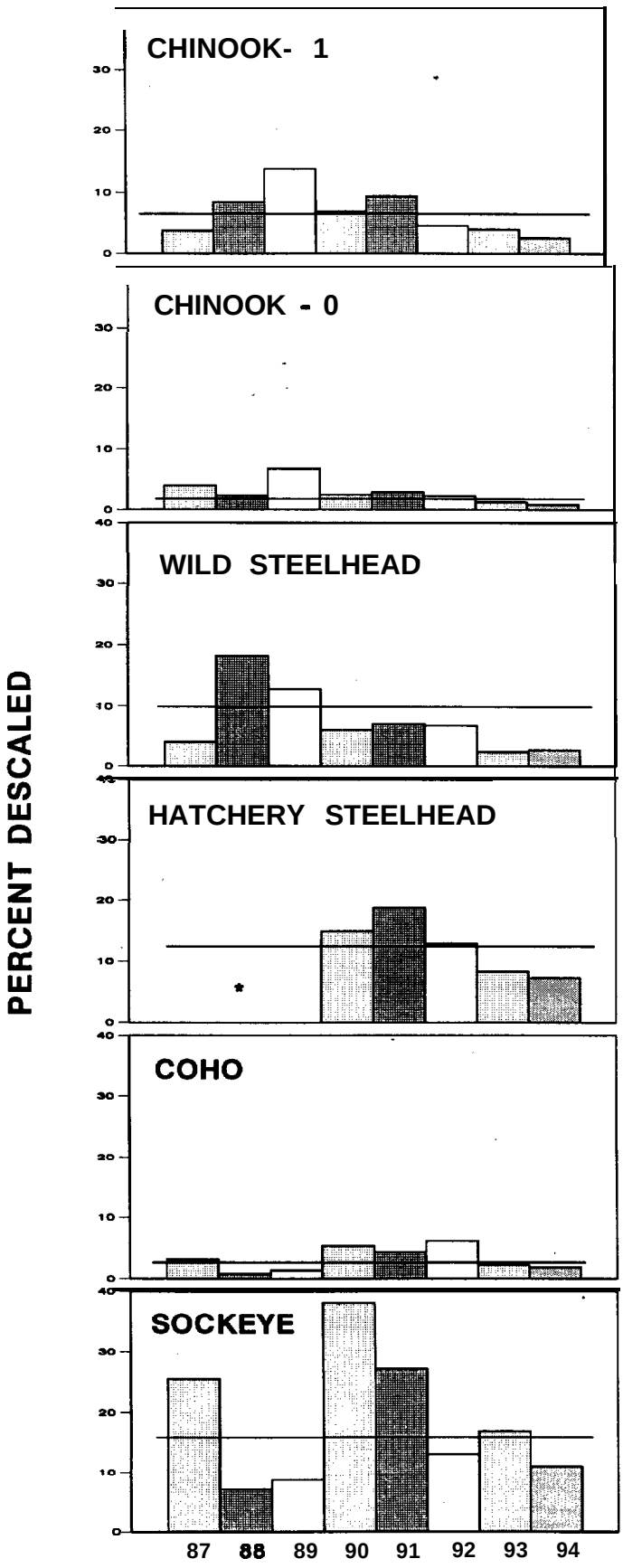

Figure 1: Historical descaling **percentaages** at Bonneville Dam, **PH#1**, 1987 - 1994.

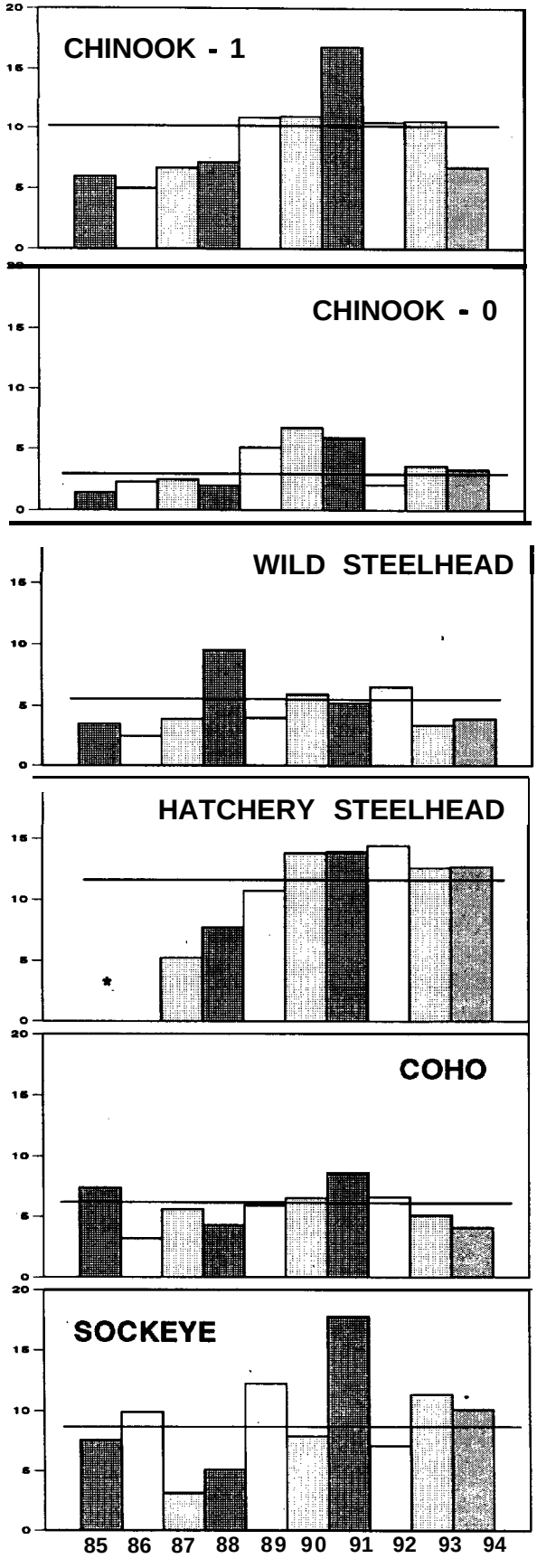

Figure 2: Historical descaling percentages at John Day Dam, 1985 - 1994.

* Hatchery and wild steelhead were not differentiated. Both groups are included as wild steelhead.

—— Designates average of all years shown.